Criminal Careers and the Crime Drop in Scotland, 1989-2011: An Exploration of Conviction Trends Across Age and Sex

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Abstract

Rates of recorded crime have been falling in many countries in Western Europe, including Scotland, since the early 1990s. This marks the reversal of a trend of increasing levels of crime seen since the 1950s. Despite this important recent change, most analyses of the 'crime drop' have focused on recorded crime or victimisation rates aggregated to national or regional level. It is little known how patterns of offending or conviction have changed at the individual level. As a result it is not known how the crime drop is manifest in changing offending or conviction rates, or how patterns of criminal careers have changed over this period. The aim of this thesis is to explore trends in convictions across a number of criminal careers parameters – the age-crime curve, prevalence and frequency, polarisation and conviction pathways – over the course of the crime drop in Scotland.

The results presented here are based on a secondary analysis of the Scottish Offenders Index, a census of convictions in Scottish courts, between 1989 and 2011. Analysis is conducted using a range of descriptive statistical techniques to examine change across age, sex and time. Change in the age-crime curve is analysed using data visualisation techniques and descriptive statistics. Standardisation and decomposition analysis is used to analyse the effects of prevalence, frequency and population change. Trends in conviction are also examined between groups identified statistically using Latent Class Analysis to assess the polarisation of convictions, and trends in the movement between these groups over time provides an indication of changing pathways of conviction.

This thesis finds a sharp contrast between falling rates of conviction for young people, particularly young men, and increases in conviction rates for those between their mid-twenties and mid-forties, with distinct periods of change between 1989-2000, 2000-2007 and 2007-2011. These trends are driven primarily by changes in the prevalence of conviction, and result in an increasingly even distribution of convictions over age. Analysis across latent classes shows some evidence of convictions becoming less polarised for younger men and women but increasingly polarised for older men and women. Similarities in trends analysed across latent

classes between men and women of the same age suggest that the process driving these trends is broadly similar within age groups. Increases in conviction rates for those over 21 are explained by both greater onset of conviction and higher persistence in conviction, particularly between 1998 and 2004.

The results of this thesis suggest that explanations of the crime drop must have a greater engagement with contrasting trends across age and sex to be able to properly explain falling conviction rates. These results also reinforce the need for criminal careers research to better understand the impact of recent changes social context on patterns of convictions over people's lives. The distinct periods identified in these results suggest a potential effect of changes in operation of the justice system in Scotland leading to high rates of convictions in the early 2000s. However, the descriptive focus of this analysis and its reliance upon administrative data from a single country mean this thesis cannot claim to definitively explain these trends. As a result, replication of this research in another jurisdiction is encouraged to assess whether trends identified are particular to Scotland.

Lay Summary

Crime has been falling in many countries in Western Europe, including Scotland, since the early 1990s. As crime is committed by people, this 'crime drop' means that either fewer people are offending, or that people who do offend are offending less. However, we known little about how patterns of offending or conviction have changed over this period of falling crime. This thesis analyses change in convictions patterns across the key characteristics of age and sex which research into 'criminal careers' – looking at different elements of the relationship between age and crime – has shown to have strong relationships with offending. In doing so, this thesis explores how the profile of people convicted in Scottish courts has changed over the course of the crime drop. Taking Scotland as an example of the crime drop, this analysis can help to understand why crime has fallen, and how criminal careers change in different periods. The analysis can also suggest how policy changes in Scotland have impacted convictions trends.

This analysis used data from the Scottish Offenders Index, a record of all people convicted in Scottish courts for offences committed between 1989 and 2011. The thesis uses statistical techniques and visual representations of data to examine change in convictions patterns for men and women of different ages. This analysis answered four research questions: First, annual change in the age-profile of men and women convicted was examined. Second, the analysis explores the different effects of the proportion of people convicted, the rate of convictions for those who are convicted and demographic change on overall conviction rates . Third, a statistical model is used to classify people into different groups based on the number of convictions of different crime types they have received. Change in the membership of these groups over time is then analysed. Finally, the thesis uses these conviction groups to examine people transition between different conviction groups at different ages, and how these patterns of transition have changed over time. Together the answers to these research questions present a picture of how patterns of criminal careers have changed over the course of the crime drop in Scotland.

The four sets of results produced show a sharp contrast between falling rates of

conviction for young people, particularly young men, and increases in conviction rates for those between their mid-twenties and mid-forties. The result is an increasingly even profile of convictions over age. However, convictions trends do not fall smoothly, with three distinct periods of change between 1989-2000, 2000-2007 and 2007-2011. The main factor driving these trends is a smaller proportion of young people being convicted, rather than demographic change or change in the rate of conviction for those who are convicted. A smaller proportion of young people were grouped into the high-volume groups estimated by the statistical model, but a higher proportion of those aged 25-40 were included in these high-volume groups. Higher conviction rates for those over the age of 21 are explained by more people continuing to be convicted at older ages and also more people receiving their first conviction after age 21.

These changes in the profile of people convicted in Scotland have wide implications for the study of the crime drop, criminal careers and Scottish justice policy. Explanations of the crime drop in Scotland and elsewhere must be able to explain differing conviction trends for men and women of different ages, and why such different patterns of convictions were seen in different periods. Those who study how offending progresses over people's lives should further explore how changes in social context, such as the crime drop, influence patterns of convictions and offending. This analysis concludes that the most likely explanation for this increase in convictions in the early 2000s are negative effects of changes in justice policy. However, as this study has only focused on Scotland this conclusion is tentative, and it is not known how far these results are typical of other countries which have also seen a crime drop. As a result, replication of this research in other countries is recommended.

Declaration

I certify that this is an original work and it has been composed solely by myself, Ben Matthews, the author signed below. This thesis has not been submitted for any other degree or professional qualification.

Ben Matthews

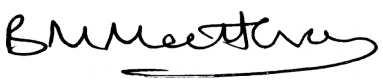

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Table of Contents

Abstract.....i
Lay Summary.....iii
Declaration.....v
Acknowledgements.....vi
Table of Contents.....vii

Chapter 1. Introduction.....1
1.1 Criminal Careers and the Crime Drop.....2
1.2 Measuring Change in Criminal Careers in Scotland.....3
1.3 Thesis aims and research questions.....5
1.4 Research Design, Methodology and Methods.....6
1.5 Key findings and overview of the argument.....7
1.6 Structure of the thesis.....8
1.7 Original contributions.....11

Chapter 2. Existing Research: Criminal Careers.....13
2.1 Introduction.....13
2.2 The age-crime curve.....14
2.3 Prevalence and Frequency.....23
2.4 Polarisation.....27
2.5 Pathways.....37
2.6 Justification for the selection of concepts.....41
2.7 Conclusions.....42

Chapter 3. Research context: the crime drop in Scotland.....45
3.1 Introduction.....45
3.2 What is the crime drop?.....45
3.3 Bridging criminal careers and explanations the crime drop.....49
3.4 Explanations of the Crime Drop.....52
3.5 The Scottish Context.....67
3.6 Distinctiveness and generalization: Scotland as a case study of the crime drop.....78
3.7 Conclusions.....79

Chapter 4. Data and Research Design.....81
4.1 Introduction.....81
4.2 Research aims, questions and strategy.....81
4.3 Data Source: Scottish Offenders Index.....83
4.4 Research Strategy.....87
4.5 Concepts and Operationalizations: Conviction, Age and Sex.....93
4.6 Concepts and Operationalizations: Dimensions of Criminal Careers.....98
4.7 Ethics and Data Access.....105
4.8 Conclusions.....108

Chapter 5. Methods.....109

5.1 Introduction....109
5.2 Data visualization and descriptive statistics....110
5.3 Standardization and Decomposition....116
5.4 Latent Class Analysis....122
5.5 Weighted cross-tabulations....133
5.6 Conclusions....136

Chapter 6. The Age-Crime Curve and the Crime Drop in Scotland....139
6.1 Introduction....139
6.2 Comparison between age-crime curves for all convictions for men and women in 1989 and 2011....140
6.3 Comparison between age-crime curves for different crime types for men and women in 1989 and 2011....143
6.4 Annual change in the age-crime curve 1989-2011....151
6.5 Annual change in the age-crime curve 1989-2011, different types of crime....155
6.6 Discussion....164
6.7 Conclusions....167

Chapter 7. Prevalence, Frequency and Age-Structure: The Anatomy of the Crime Drop....169
7.1 Introduction....169
7.2 Descriptive statistics for frequency and age-structure....170
7.3 Standardization and Decomposition of Convicted Offending Rates: 1989-2011 180
7.4 Standardization and Decomposition: Comparing 1989-2000, 2000-2007 and 2007-2011....188
7.5 Discussion....198
7.6 Conclusions....201

Chapter Eight: A crime drop for whom? polarisation and the crime drop....203
8.1 Introduction....203
8.2 Identifying a LCA solution....204
8.3 Change in polarisation over time....210
8.4 Using LCA to examine the generality of declining convictions across types of crime....223
8.5 Discussion....229
8.6 Conclusions....231

Chapter Nine: Transitions between convictions classes and the crime drop....235
9.1 Introduction....235
9.2 Descriptive statistics: Trends in desistance, persistence and onset....236
9.3 Transitions between Latent Classes....245
9.4 Change in transitions over time....249
9.5 Discussion....259
9.6 Conclusions....264

Chapter 10. Discussion and Conclusions....267
10.1 Introduction....267
10.2 Summary of results....268
10.3 The crime drop in Scotland....268

10.4 Implications for theories of the crime drop....272
10.5 Justice policy in Scotland....279
10.6 Implications for Criminal Careers Research....283
10.7 Original contributions....287
10.8 Limitations and areas for further research....289
10.8 Summing Up....290

Appendices....292

Bibliography....337

Chapter 1. Introduction

"Everything flows"

- Heraclitus

The origins of this thesis were rather prosaic. At its inception, this project set out to explore the development of criminal careers based on data held in the Scottish Offenders Index (SOI), a database of convictions served in Scottish courts. One of the benefits – and as it transpired, challenges – of working with SOI was the size of the dataset, which spanned from the late 1980s to the early 2010s. This wide coverage raised what appeared to be a straightforward question of data analysis; how similar are patterns of convictions in data from twenty years ago to criminal careers now? However, this question was the genesis of what would become the focus of this thesis; investigating how criminal careers have changed over a period of dramatic falls in recorded crime rates. The background of the 'crime drop' raised the question of the contemporary relevance of the earliest convictions in SOI, bringing together two bodies of criminological thought: the study of micro-level criminal careers and the analysis of macro-level crime rates. The intersection of these two elements – criminal careers and the crime drop – is central to this thesis.

As well as the central aspects of criminal careers and the crime drop, there is also a third element to this analysis; the Scottish context. In this thesis Scotland is a case study of change in criminal careers over the course of the crime drop, which requires reflection on the peculiarities of the Scottish case. Understanding the changing policy context in Scotland is necessary to understand how far results observed here can be generalized, but also allows this analysis to provide new insights into how the justice system in Scotland operated over the period being studied.

This introductory chapter illustrates how the areas of criminal careers, the crime drop and the Scottish context interact, and how these three elements feed into the aims of this thesis. This chapter then presents an overview of the argument made throughout this thesis, before laying out the structure of the work that follows.

1.1 Criminal Careers and the Crime Drop

Crime rates have been falling in much of North America, Europe and Australasia since the early 1990s (Farrell et al. 2014). This followed a trend of increasing rates of crime seen across Western Europe since the 1950s (van Dijk and Tseloni 2012). This 'crime drop'[1] has been described as "the most important criminological phenomenon of modern times" (Farrell et al. 2014:421), and sparked a large volume of recent research to understand and explain these trends[2]. This research has provided a number of potential explanations for why crime rates have fallen (Farrell 2013), but importantly, the way in which these explanations have been constructed has essentially been inductive (see Baumer 2010:4). First, crime trends are described across countries – and with some notable exceptions (Bates, Pillinger and McVie, personal communication), analysis of the crime drop has focused primarily on national-level crime rates (for example Tonry 2014, Aebi and Linde 2010, 2012) – and across types of crime. Then, based on these descriptions, hypotheses are developed and then tested to assess why these trends are observed, with hypotheses that do not fit with observed trends being rejected (Farrell 2013).

The limitation of this kind of inductive reasoning is that change in aggregate rates may reflect different, and potentially opposite, trends for different sub-groups within the population, a form of Simpson's paradox (Simpson 1951). It should not be inferred from falls in aggregate crime rates that all groups in the population have shown declines in offending. This is particularly important given that patterns of offending vary substantially by sex and age (Gottfredson and Hirschi 1983, Farrington 1986). As explanations of the crime drop have been developed by working backwards from descriptions of national-level crime trends, such explanations leave fundamental descriptive questions about the "anatomy" (Berg et al. 2016) of the crime drop unanswered. Explanations of the crime drop may be trying to fit a single explanation to all groups within a population when different groups show very different trends.

Berg et al. (2016) provide an example of this problem, asking whether the crime

1 The same phenomenon is sometimes termed the 'crime decline' (for example, Zimring, 2007).
2 For example a recent edition of *Crime and Justice* (Volume 43, 1) was dedicated to this question.

drop reflects fewer people offending (the prevalence of offending), less offending by those who do offend (the frequency of offending), or both (see also Farrell et al. 2015)? In posing this question, Berg et al. draw on concepts of prevalence and frequency from criminal careers research (see Blumstein et al. 1986). By making the link between the descriptive work required to understand the crime drop and the established body of criminal careers research, Berg and colleagues demonstrate that concepts from criminal careers research offer helpful ways to articulate the 'anatomy' of the crime drop Whilst Berg et al.'s focus on trends in the prevalence and frequency of offending other criminal careers concepts can also be used to analyse the crime drop (Farrell et al. 2015).

Importantly, the link between criminal careers and the crime drop cuts both ways. For those who study the relationship between age and crime, societal change such as the recent crime drop provides the "missing link" (Sampson 2015:278, Sampson and Laub 2016:328) in the understanding of how offending behaviour develops. This is because a full understanding of the development of offending behaviour requires accounting for social change; people age in different 'social worlds' (Sampson 2015:280), with different cohorts experiencing differing conditions at the same age. Not only can exploring change in criminal careers over the course of the crime drop help in developing explanations of the crime drop, it can also help to better understand the development of criminal careers. This interaction between age, crime and social context is a key component of what Sampson and Laub (2016) term 'life-course' criminology. Using concepts from criminal careers research to investigate changes in aggregate crime trends unmoors these concepts from the typical, "largely social-psychological" perspective of developmental criminology (Sampson 2015:280; see also McAra and McVie 2012). Rather than using these concepts to assess the causes and correlates of crime at the individual level, criminal careers concepts are used here to describe how convictions patterns have changed over time in order to understand trends in aggregate crime rates. Whilst these concepts are drawn from the field of developmental criminology, the aims of this research are not those typical of this field.

1.2 Measuring Change in Criminal Careers in Scotland

Exploring change over time in criminal careers requires a strong empirical aspect to

this thesis[3]. This puts the data source used in a central role. To fulfil the data requirements of analysing change over time in convictions trends across men and women of different ages, this thesis draws on the Scottish Offenders Index. The SOI is a record of convictions[4] in Scottish courts between January 1st 1989 and July 31st 2013. This breadth of coverage allows the flexibility to analyse multiple aspects of criminal careers over time. Of course, the flexibility of SOI would be moot as a resource to understand changing patterns of criminal careers over the crime drop if there had been no crime drop in Scotland. Scotland has seen falls in recorded crime and convictions similar to other countries in Western Europe, with reductions in acquisitive crime driving falls in recorded crime (Scottish Government 2013) and convictions (Aebi and Linde 2012). This makes analysis of conviction trends in SOI a suitable case study of criminal careers and the crime drop, although generalization from Scotland to other countries must be done with care[5].

As convictions data are social constructions, their interpretation cannot be divorced from an understanding of the context of their production (Francis et al. 2004a). The relationship between offending and conviction is complex (see McAra and McVie 2010a), and convictions data should not be read as a perfect measure of offending (Aebi and Linde 2012)[6]. The use of SOI as a data source, and so Scotland as a case study of change in criminal careers over the crime drop, therefore requires an understanding of how the justice system in Scotland has changed over the period to which SOI relates. Such contextual knowledge is required to make an informed judgement as to whether trends observed in SOI are more likely to reflect behavioural change in offending or change in the way the justice system is punishing offending.

Understanding the potential impacts of policy change is particularly important because, as well as coinciding with the crime drop, the data contained in SOI also overlaps with a particularly turbulent time for the justice system in Scotland (McAra 2006, 2008). These changes are discussed more fully in Chapter Three, but it is

3 This is true for all studies of change over time in the relationship between age and crime (Steffensmeier et al. 1989).
4 SOI does not include convictions for motor vehicle offences, or crimes against public justice. The intricacies of SOI and precisely how it is used in this thesis are discussed in Chapter Four.
5 The extent to which Scotland can be considered as a representative case study of the crime drop is discussed in Chapter Three.
6 The way convictions are interpreted in this thesis are discussed in Chapter Four.

important to note here that this policy change raised concerns about more people being brought into the justice system (Piacentini and Walters 2006) and remaining in the justice system (McAra and McVie 2010a) during this period. Making such an assessment can help both when generalizing results from SOI to other jurisdiction and can also give an indication of the potential impacts of policy change on convictions patterns observed in SOI. In the same way that examining recent change in criminal careers can help understand the crime drop, doing so using data from Scottish courts can inform about the development of the justice system in Scotland.

1.3 Thesis aims and research questions

Drawing together these three strands of criminal careers, the crime drop and Scottish justice policy, this thesis has three aims. The first aim of this thesis is to explore trends in Scottish convictions data over the course of the crime drop across different parameters of criminal careers, in order to understand how patterns of criminal careers have change over the course of the crime drop in Scotland. At the heart of this aim is the analysis of change across the key demographic variables of age and sex, which are well established as having an important relationship with patterns of crime (Farrington 1986, Gove 1985, Newburn and Stanko 1994). The second aim is to use descriptions of change across different criminal career parameters to better understand the mechanisms driving the crime drop. This aim is achieved by comparing observed results with the expectations of different theories of the crime drop, and using the results to highlight areas in which existing explanations of the crime drop need to be refined. The third aim is to compare trends in criminal careers with changes in justice policy in Scotland. This provides a new perspective on the impacts of justice system changes in Scotland between 1989 and 2011, and also helps to understand whether observed change in convictions is better understood as reflecting behavioural or system change.

These three aims are achieved by answering four research questions:

1. *How has the aggregate age-crime curve changed over the course of the crime drop in Scotland for men and women and across crime type?*
2. *What are the contributions of prevalence, frequency and age-structure to falling conviction rates?*

3. *Has the distribution of convictions become more polarised over the crime drop in Scotland?*
4. *How have pathways between latent convictions groups changed over the course of the crime drop in Scotland?*

By answering these research questions this thesis provides a detailed understanding of how patterns of criminal careers have changed over the course of the crime drop in Scotland. This understanding is then used to reflect upon the mechanisms influencing falling conviction rates and as well as the impacts of policy change upon conviction rates.

1.4 Research Design, Methodology and Methods

This thesis adopts an exploratory approach, using quantitative methodology and a variety of statistical techniques and data visualisations to examine change in convictions patterns for men and women of different ages. Change in the age-crime curve is analysed using shaded contour plots (Minton et al. 2013; Vaupel et al. 1987). Standardization and decomposition (Kitagawa 1964, Das Gupta 1993) are used to compare changes in prevalence, frequency and age-structure. Latent Class Analysis (LCA, McCutcheon 1987) is used to group people together based on their convictions patterns, and so to analyse whether the convicted population has become more polarised over the course of the crime drop. The classification produced by LCA is then used to explore change in pathways of convictions. The focus of each of these methods is on providing a description of trends in SOI, rather than an inferential or causal analysis. This exploratory focus means that, when using results to reflect upon mechanisms leading to the crime drop, this thesis does not seek to 'test' the effects of particular theories. Rather, the focus of this analysis is on providing new information by which explanations for the crime drop can be refined.

A key part of the research design of this thesis is the use of comparison across multiple cohorts at multiple time points as a way to indicate of whether trends observed are period (affecting all age groups in a given time span) or cohort effects (affecting all people born in a given year). Distinguishing between period and cohort effects is an important way to distinguish between potential mechanisms influencing these trends (Kim et al. 2015). However, the exploratory nature of the analysis

means that partitioning of trends into period and cohort effects must be considered tentative.

1.5 Key findings and overview of the argument

The key finding of this thesis is that the crime drop in Scotland is reflected in sharply contrasting trends in convictions for young and old, for men and women and over different periods. As measured by convictions data, the crime drop is not a general process but rather one that is highly patterned by sex and age. The central claim of this thesis is that our understanding of both criminal careers and the crime drop must account for these changing patterns of conviction over time. This means focusing on exploring changing patterns of criminal careers between different cohorts (Sampson 2015), and constructing explanations for the crime drop which can explain very different convictions trends for different age groups.

This thesis also argues that it may be misleading to consider the period from the early 1990s to the late 2000s as a homogeneous 'crime drop'. The contrasting trends seen in different periods are mostly likely caused by the interplay of different factors in different periods, rather than by the same mechanism applying over both periods of declining convictions and the intervening period of increasing convictions identified in SOI. Whilst explanations for the crime drop have typically sought to produce a single cause for the crime drop (Farrell 2013), this thesis argues that a compelling explanation of why crime has fallen must account for differing trends, and so differing effects, in different periods (Humphreys et al. 2014).

The similarities in the timing of increasing prevalence and decreasing desistance[7] for people of different ages and for men and women found in this thesis are taken to imply a period effect. This is interpreted as a system effect, coinciding with a period in which justice policy in Scotland became especially punitive (McAra 2016). Therefore, the results of this thesis suggest that changes in justice policy in Scotland around the period of devolution had the effect of increasing both the numbers of people coming into contact with the justice system, and increasing the proportion of people who persisted in conviction after their initial conviction. Falling conviction

7 "Desistance" as used here relates only to a period of five years without a conviction. This use of the term desistance, which differs from elsewhere in the criminological literature (for example, Maruna 2001, Gadd and Farrall 2004) is discussed in Chapter Four.

rates after 2007 coincide with a further shift in Scottish justice policy (McAra 2016), although it is less clear as to whether there was an effect of justice policy in reducing convictions during this period.

1.6 Structure of the thesis

The rest of this thesis is structured into the following four sections:

Section One: Setting up the problem

Chapters Two and Three comprise the first section, laying out the problem to be addressed in the rest of the thesis based on a review the existing literature. Chapter Two reviews the criminal careers literature, presenting the four key criminal career concepts which inform this thesis – the age-crime curve, prevalence and frequency, polarisation and transitions – and how these concepts are adapted to suit the particular aims of this thesis. Chapter Three describes the research context. The first part of Chapter Three covers research describing and attempting to explain the international crime drop and how these explanations mesh with criminal careers concepts. The second section reviews the relevant work into how the justice system in Scotland has changed over the period covered by the crime drop, to both inform analysis of convictions trends and to understand the similarities and differences between falling crime trends in Scotland and elsewhere. The work reviewed in this chapter provides an indication of how representative Scotland is as a case study of the crime drop.

Section Two: How to investigate the problem

The second section of the thesis comprises Chapters Four and Five. Chapter Four begins by outlining the gaps in the literature identified in Chapters Two and Three, stating the aims of this thesis and presenting the four research questions which inform this analysis. It then outlines research design used to fulfil these aims. The chapter then introduces the SOI as a data source and discusses how the features of SOI impact upon the analysis conducted. After this the chapter describes how the key criminal careers concepts informing this thesis are operationalized. It concludes by discussing data access procedures used in gaining access to SOI and the ethical challenges involved in conducting research on administrative data.

Chapter Five outlines the specific methods – shaded contour plots, standardization and decomposition, LCA and weighted cross-tabs – used to meet the aims of the thesis, and discusses the implications of the use of these methods upon observed results. As well as providing technical details of these methods and how they are implemented, Chapter Five discusses the benefits of these methods as opposed to alternative methods which could have been adopted.

Section Three: Results

The third section of this thesis presents the results. This section comprises four chapters, with one chapter dedicated to the analysis of each concept from criminal careers research: the age-crime curve, prevalence and frequency, polarisation and pathways of crime.

Chapter Six uses shaded contour plots to analyse change in the age-crime curve over the period covered by SOI. This analysis illustrates that falls in total convictions are due to lower rates of convictions for those under the age of 25, whilst convictions rates for those between 25 and 40 increase over the period analysed. These results display contrasting trends for men and women and between different types of crime, with falls in convictions during the 1990s being driven by fewer men convicted for crimes of dishonesty, whilst after 2007 conviction rates decline for young men and young women across all types of crime.

Chapter Seven compares these changes in prevalence with the impact of changing population structure and frequency of conviction. These results illustrate that prevalence plays a much greater role in falling convictions rates than frequency. Population change showed an important impact in lowering conviction rates in the 1990s but very little effect in reducing convictions since 2007. Once again, the impact of the prevalence, frequency and age structure is demonstrated to vary between men and women and for people of different ages.

Chapter Eight explores whether the population of those convicted in Scotland has become more polarised. Polarisation is assessed by examining change in the membership of different groups of offender identified statistically using LCA. The LCA solution identified suggested three conviction groups as most appropriate to

summarize convictions patterns in SOI; a High-rate class, a Low-rate class and a class with high rates of convictions for crimes of dishonesty, referred to as the Dishonesty class[8]. If the proportion of low rate offenders, or the proportion of total convictions served to low rate offenders, increases, convictions can be considered less polarised. Falling youth convictions identified in Chapter Six are seen across the three classes, but particularly for the Dishonesty class. As a result, the proportion of young people assigned to the Low class increases, suggesting that overall is less polarised between High and Low-rate groups. Falls in the membership of the Dishonesty class are, perhaps unsurprisingly, driven by lower rates of crimes of dishonesty. However, convictions for dishonesty fall by similar magnitudes for *all* of the classes identified. This implies that the mechanism driving these declines is a general one, rather than one concentrated in a particular group of offenders. In contrast to lower polarisation of young people, membership of High-rate and Dishonesty classes increase as a proportion of all convictions for older men and women, indicating higher levels of polarisation over the course of the crime drop for these groups. The combined effect of these trends is that those classified into the high-rate class make up a consistent proportion of all offenders, but the age and sex composition of this class is less skewed towards young men by the end of the period analysed.

The final results chapter, Chapter Nine, uses the concept of pathways of conviction to examine longitudinal convictions patterns and how these patterns have changed over time. The findings of this chapter show relative falls in the prevalence of desistance pathways and increases in persistence pathways for all ages, and increases in onset pathways after the age of 21. Whilst both men and women display effects of increased persistence and onset[9], persistence has a relatively larger effect for young women and onset has a larger effect for young men. These findings indicate that falling conviction rates are due to fewer young people receiving a first conviction, and not because of greater desistance. These increases in persistence and onset predominately cover the period from 1998 to 2004. That these trends are broadly consistent across latent classes and over age suggests a period effect leading to these increases in persistence and onset. These results are interpreted as relating

8 In Scotland, crimes of dishonesty cover acquisitive crime (see Chapter Four).

9 "Onset" is used to refer to a person having one five year period with no conviction and followed by (at least one) conviction in the next five-year period. Again, this is usage differs from elsewhere in the literature (Blumstein et al. 1986), and is discussed in Chapter Four.

to the 'punitive turn' (McAra 2016) in Scottish justice policy which coincided with these increases in persistence and onset.

Section Four: Discussion and Conclusion

Chapter Ten draws together the different themes presented across the four results chapters and reflects upon the implications of these results for the study of criminal careers, the crime drop and the development of Scottish justice policy. Based on these results it is argued that there has been important change in patterns of criminal careers over the course of the crime drop. This chapter compares the results presented in Chapters Six through Nine with the expectations of different theories of the crime drop as discussed in Chapter Three. This chapter also compares the observed results with the discussion of justice policy changes presented in Chapter Three. The results suggest that the justice system in Scotland has had little impact in reducing overall rates of convictions, but rather policy change around devolution may well have increased conviction rates. The thesis concludes by discussing the policy and methodological implications of this work, illustrating the original contributions of this analysis and its limitations and finally providing suggestions for areas of future research.

1.7 Original contributions

This thesis makes original contributions to the study of criminal careers, the crime drop and Scottish justice policy. First, this thesis provides the most complete description to date of change in criminal careers over the course of the crime drop, by examining annual change across multiple dimensions of criminal careers for men and women of multiple cohorts. The value of this contribution is enhanced by conducting this analysis in a previous unexplored case (i.e. Scotland), allowing an understanding as to the limits of generalizability from US studies of criminal careers and the crime drop. Similarly, the differences in trends seen for men and women demonstrate that understandings of how criminal careers have changed over the crime drop are incomplete without an analysis of sex differences. This is an important, but not previously researched, consideration both for the study of temporal change in criminal careers and for criminologists' understanding of the mechanisms driving the crime drop. Finally, in reconciling descriptions of criminal

careers with changes in policy periods in Scotland this analysis provides a new perspective on the impacts of justice policy change. The results agree with previous analyses which suggest that the 'punitive turn' (McAra 2016) served to bring more people into the justice system and to keep them in the justice system for longer.

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Having set the scene, the following chapter introduces the four key concepts from criminal careers that inform this thesis, and show how these concepts can be used to describe change over time.

Chapter 2. Existing Research: Criminal Careers

2.1 Introduction

As discussed in the introductory chapter, the idea of the criminal career is of central importance to this thesis. The aim of this chapter is to introduce the four criminal career concepts employed in this study – the age-crime curve, prevalence and frequency, polarisation and pathways – setting out the way these concepts are defined and employed in this study, and how the use of these concepts in this thesis relates to their use in the wider literature. Of particular importance is how these criminal career concepts can be used to describe trends over time, and how this usage diverges from the aims of much existing research into criminal careers. This chapter also provides the justification for the use of these particular criminal careers concepts as opposed to other aspects of criminal careers identified in the existing literature.

On The Term 'Criminal Careers'

As defined by the National Research Council report *Criminal Careers and "Career Criminals",* a criminal career is "the longitudinal sequence of crimes committed by an individual offender" (Blumstein et al. 1986:12). Since this report was published the term criminal careers became associated with the particular research paradigm of the report's authors[10], with a focus on empirical examination of the correlates of different 'dimensions' of the criminal career (Blumstein et al. 1986), such as onset, desistance, prevalence and frequency. This approach is often contrasted with that of researchers who disagreed with the division of offending into these different dimensions, most prominently Gottfredson and Hirschi who sustained a long and fractious debate with the criminal careers researchers through the late 1980s (Gottfredson and Hirschi 1986, 1987, 1988; Blumstein et al. 1988a, 1988b).

The term 'criminal careers', then, is a loaded one. By referring to criminal careers in this thesis it is not intended to align this research with the perspective of Blumstein

10 The criminal career paradigm relates to the division of aggregate crime rates into contributions from different dimensions of the criminal career, and in particular prevalence and frequency (Piquero et al. 2003:361).

and colleagues. Indeed, in many ways the aims of this research are very different from those of Blumstein et al. (1986) and the emphasis of these authors on the empirical assessment of factors correlated with different criminal career dimensions. Instead, the focus of this thesis is on using different concepts drawn from research describing the relationship between age and crime to describe change in aggregate crime rates. Consequently, the term 'criminal careers' is used here to signify interest in examining multiple aspects of the relationship between age and crime, acting as an umbrella term used to indicate that there are multiple dimensions of the relationship of crime with age which are of interest. This includes broad concepts such as the age-crime curve, as well as specific parameters of criminal careers, such as prevalence and frequency as outlined by Blumstein et al. (1986). In this chapter, the four aspects of the relationship between age and crime studied here – the age-crime curve, prevalence and frequency, polarisation and pathways – are discussed in turn. First they are defined, then the previous research into how these dimensions of criminal careers change over time are discussed.

2.2 The age-crime curve

The age-crime curve, the observation that young people typically offend, are arrested and are convicted at a higher rates than older people, provides a helpful illustration of how concepts related to age and crime can be used to understand change in aggregate crime trends. This curve has an "asymmetrical bell shape", which shows that the proportion of people who offend increases through adolescence, peaks in the teenage years and then declines from the late-teens or early twenties (Loeber and Farrington 2014:12). Figure 2.1 illustrates this adolescent peak in the arrest rate for men in the USA in 1982.

To some extent it is misleading to describe the age-crime curve as a concept drawn from the criminal careers research, as the age-crime curve has a much longer history in criminology than the (relatively) recent focus on criminal careers[11]. Indeed, the observation of the age-crime curve was itself part of the justification of the criminal careers approach (Blumstein et al. 1986). However, the age-crime curve is an important starting point in examining change in different dimensions of criminal

11 This typical distribution of age and crime was first identified by Adolphe Quetelet in 1831(2003 [1831]).

careers over time. The identification of the age-crime curve as defined above is predicated on the stability of this distribution over time (Quetelet 2003[1831]). Consequently, there are a number of existing studies that have described change in the age-crime curve over time. These studies of the age-crime curve provide the best example of how the examination of change over time in different dimensions of criminal careers can be approached.

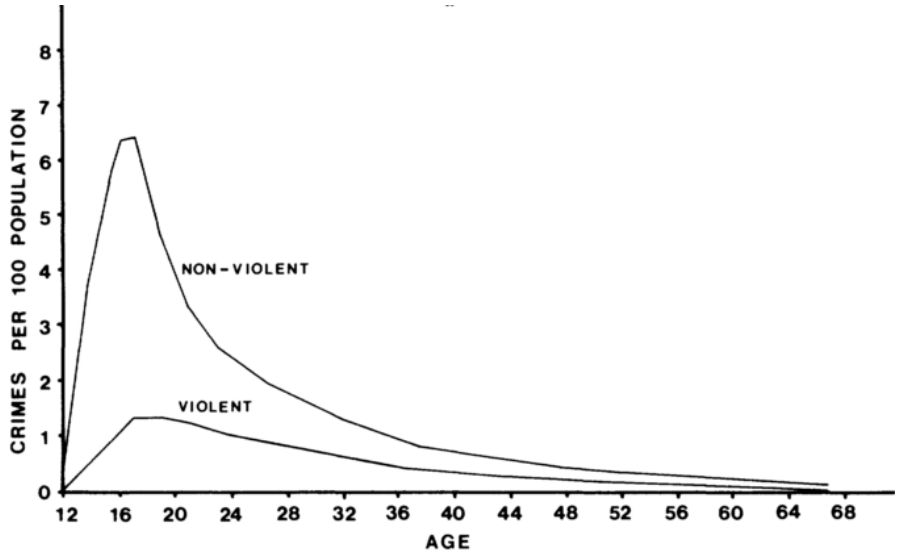

Figure 2.1 The relation between age and crime for American males. Figure show arrests per 100 population for Index offences in the year 1982. Source: Federal Bureau of Investigation (1983). Adapted from Figure 2 in Farrington (1986:193)

There have been two recent periods of sustained interest in examining temporal change in the age-crime curve, each with different aims. The first of these periods came in the 1980s as part of the visceral debate regarding the value of the 'criminal careers' paradigm. As part of this debate a number of papers were published examining whether the age-crime curve should be considered 'variant' or 'invariant'; in essence, whether there was meaningful change in the age-crime curve over time and in different places. As is discussed below, this variance/invariance debate was focused on the use of change in the age-crime curve as a way to understand the *individual* level relationship between age and crime, similar to what Wilson (2012) calls *micro*-criminology[12]. The second period began in the mid-2000s, with a

12 Micro-criminology is defined by Wilson as "understanding individual differences in offending" (2012:229)

number of researchers examining change in the age-crime curve since the start of the crime drop. These recent studies have primarily been motivated by understanding how the crime drop has been manifest in changing arrest or conviction rates across age, giving these studies a focus more in line with *macro*-criminology[13] (Wilson 2012). These contemporary studies of the age-crime curve have aims more closely aligned with those of this thesis than those conducted during the 'great debate', using variation in the age-crime curve to as a way to describe the development of the crime drop. However, both periods of research into the age-crime curve are important for this thesis as they demonstrate the presence of empirical change over time in the age-crime curve, as well as highlighting aspects of research design which this thesis builds upon. Together these analyses of change in the age-crime curve provide a framework which can be extended to the three other criminal careers parameters analysed.

The 'great debate': is the age-crime curve variant or invariant?

The 1980s saw vigorous debate as to whether the age-crime curve should be considered universally invariant. On one side of this debate, Gottfredson and Hirschi argued that the age-crime curve should be understood as consistent across time, place and social conditions (Hirschi and Gottfredson 1983) – the invariance thesis. In contrast, others (Greenberg 1985; Farrington 1986; Steffensmeier et al. 1989) emphasised variation in the empirical relationship between age and crime over time, between (and within) countries over time and between men and women. For example, analysing age-crime curves based on convictions data from England and Wales between 1938 and 1983, Farrington (1986:196) showed that men typically had higher offending rates than women at each age, and an age-crime curve more concentrated around youth offending. In addition, the age-crime curves for men and women showed different patterns of change over time. For the current analysis, these studies suggest the importance of examining change in the age-crime curve for men and women separately as well as for different crime types.

Importantly, though, the variance/invariance debate was not about whether there was *any* variation in the age-crime curve. Even Hirschi and Gottfredson, despite claiming that age-crime curves from different countries in different periods were

13 Defined as "understanding changes in the national crime rate" (Wilson 2012:229).

"indistinguishable" (1983:555), accepted that there was empirical change in the age-crime curve over time (1983:572, footnote 13). Rather, the crux of this debate was whether this observed variation in the age-crime curve was *meaningful*. Within the frame of this debate, meaning could be attributed to observed variation in the age-crime curve if this variation helped to understand the causes of notable correlation of crime and age at the individual level. What was considered invariant was the causal effect of age on crime, not the empirical manifestation of this effect[14].

To some extent, the different perspectives on whether the variation in the age-crime curve was meaningful taken by the two sides of the variance/invariance debate were a matter of different parties interpreting the same results differently (Tittle and Grasmick 1998:312; Gottfredson and Hirschi 1988:42) and of semantics (Tittle 1988; Britt 1992). Given the difficulty of proving whether the age-crime curve should be universally considered as variant or invariant it is perhaps unsurprising that this debate did not lead to a firm resolution. What is key for this thesis is that, despite the strong contention from Hirschi and Gottfredson (1983) that the relationship between age and crime should be considered invariant, the research conducted into the age-crime curve as part of this debate illustrated that there *is* empirical change in the age-crime curve over time. Moreover, this change may be manifest differently across crime type and for men and women.

Rediscovering the age-crime curve

After a period in which there was little published analysis of variation in the age-crime curve, recently a number of studies (Blumstein 2006; Cook and Laub 2002; Farrell et al. 2015 and Kim et al. 2015) have analysed change in the age-crime curve with the aim of better understanding the 1990s crime drop. Analysis of the age-crime curve helps to understand macro-level trends in crime rates by assessing whether change in crime has been uniform across age or whether it is concentrated in change for particular age groups (Kim et al. 2015). Precisely how change in the age-crime curve is linked to explanations of the crime drop is discussed in Chapter Three, but it is important to note here that these contemporary studies have a very different aim from the analysis of change in the age-crime curve as part of the 'great

14 Hirschi and Gottfredson state that "variation in the location of the curve on the age axis across time, place, and such demographic factors as sex or even type of offense may say little or nothing about the impact of *age on criminality*" (1983:572, footnote 13, emphasis added).

debate' in the 1980s. Rather than analyse the age-crime curve as a way to understand the individual-level relationship between a person's age and their propensity to offend, these contemporary studies use variation in the age-crime curve to help unpick macro-level trends in crime. This is more in line with the concerns of *macro*-criminology than micro-criminology (Wilson 2012). We can see the distinction between these two interpretations of variation in the age-crime curve in the caution by Loeber and Farrington – who adhere to more typical micro-criminological concerns – against the analysis of the cross-sectional distribution of age and crime. They contend that cohort age-crime curves (those which follow a group of people born in a particular year over time) are to be preferred over aggregate age-crime curves (crime rates for people of different ages in the same year) to avoid the "confounding influence of multiple cohorts" (2014:13). But for those interested in using the age-crime curve to understand change in aggregate crime rates it is exactly this kind of cross-sectional analysis and this mix of cohorts that is of interest; the effects of cohort differences are only confounding if the aim is to assess the relationship between age and crime at the individual level.

The results of analyses of change in the age-crime curve over the crime drop raise a number of important points for this thesis. Whilst the methods and data sources used in these studies differ, they agree on one central point; the crime drop in the USA since the early 1990s is explained by lower rates of offending amongst young people. In other words, the crime drop is a youth crime drop. This finding is demonstrated by Blumstein (2006), Cook and Laub (2002), Farrell et al. (2015) and Kim et al. (2015) each of whom examine arrest rates from the USA. These studies consistently described sharp falls in youth arrest rates, despite focusing on trends across very different crime types – homicides between 1985 and 2001 (Blumstein 2006), violent crime between 1994 and 1999 (Cook and Laub 2002), change across multiple crime types between 1980 and 2010 (Farrell et al. 2015), and for total arrests between 1990 and 2010 respectively (Kim et al. 2015). Whilst there has been less analysis of change in the age-crime curve outside the USA, some European studies have also shown recent declines in youth convictions such as Soothill et al. (2008) and Morgan (2014) in England and Wales and Bäckman et al. (2014) and (von Hofer, 2014) in Sweden. These findings highlight that understanding change in the age-crime curve is an important part of the crime drop.

Much less consistent among these studies are the patterns of change in offending beyond young adulthood, with different studies showing different trends in arrest or conviction for those in their thirties and older. For example, Farrell et al. (2015) show increasing violent arrest rates of around 7-9% for those in their late forties and fifties between 1994 and 2010, and an increase in property arrest rates of over 20% for those aged 45-49 between 1988 and 2010. Similarly, Kim et al. (2015) saw increases in arrest rates for those aged 40 and over of between 42% and 84.6%. However, these increases were not seen by Blumstein (2006) who found declining homicide arrest rates for those in their forties. These contrasting findings provide an indication that different crime types may have shown different patterns of change in their respective age-crime curves over the crime drop (see Farrell et al. 2015). Moreover, despite international similarities in falling youth crime, findings from the USA for older age groups may not travel quite so well. Morgan (2014:22) analysed the numbers of people convicted or cautioned in England and Wales between 1995 and 2013 aggregated into ten-year age windows and found that the numbers of those aged 10-20 and 21-30 convicted or cautioned have fallen, but the numbers of those aged 31 and older have increased over the same period. Taken together, these findings show that the crime drop in the USA and the UK has not been reflected in even change across the age distribution, with a strong consensus showing falling youth crime but less consistency in trends for older age groups. This emphasises the importance of examining conviction trends disaggregated for different age groups. The contrasting findings across different crime types reinforce the findings from the 'great debate' (e.g. Farrington 1986) which emphasised the importance of differences in the age-crime curve between crime types.

Limitations of recent studies into the age-crime curve and the crime drop

Whilst the studies analysing change in the age-crime curve over the course of the crime drop demonstrate important differences across age in declining crime trends, they have three key limitations. First is their focus on US data. Of the studies identified which have examined change in the age-crime curve over the crime drop, all but Morgan's (2014) discussion of change in the numbers of people convicted or cautioned in England and Wales focused on US arrest data[15]. Whilst this is not a

15 Hiraiwa-Hasegawa (2005) analysed the age distribution of falls in conviction rates in Japan

limitation *per se*, as will be discussed in Chapter Three the crime drop has not been experienced in the same way in Europe as in the USA (Aebi and Linde, 2010). Whilst the US crime drop during the 1990s saw falls in rates of crimes of all crime types, in Europe the crime drop was concentrated in acquisitive crime. This has led to questions about the capacity to generalize findings from US studies to Europe (Aebi and Linde 2010), and highlights the value of examining change in the age-crime curve over the course of the crime drop using European data. Doing so in a country other than England and Wales can provide a useful counterpoint to Morgan's (2014) analysis, helping to understand how generalizable trends in USA data are to other countries in Europe.

A second limitation of contemporary studies of the age-crime curve is that they have not analysed change in the age-crime curve separately for men and women. Sex differences in the age-crime curve have been noted since its discovery (Quetelet, 2003[1831]) and were emphasised during the 'great debate' regarding criminal careers. Understanding differences between men and women in how the age-crime curve has changed over the course of the crime drop are made even more important by the number of recent studies which identified differing recent trends in offending for men and women leading to a declining 'gender gap' in crime. In England and Wales, Soothill et al. (2003) found that the total number of people convicted between the ages of 10 and 21 had declined for both men and women between cohorts born in 1973 and 1978 but by a greater extent for men than women. Men born in 1978 received 18.6% fewer offences than the 1973 cohort, with women in the 1978 cohort receiving 10.2% fewer offences than the 1973 group[16]. In Sweden, both von Hofer (2014) and Bäckman et al. (2014) compared the convictions patterns of different cohorts born between 1958-1991 and found declines in the prevalence of convictions in younger cohorts, predominately driven by declines in the rate of men receiving convictions. Estrada et al. (2015) reported a similar finding of a greater

between 1955 and 2000, but the majority of this decline in Japanese homicide rates came between 1955 and 1980. This is of questionable relevance to understanding the international crime drop since the early 1990s. The studies of Von Hofer (2014) and Bäckman et al. (2014) focused on convictions data across different birth cohorts. This gave these studies a focus on youth conviction and prevented comparison of convictions trends for older age groups, making them unable to investigate change across the full age distribution.

16 Figures are author's own calculations based on Tables 1 and 2 in Soothill et al. (2003). Note that these are raw totals, not adjusted for population change. Soothill and colleagues also compare convictions across a number of older cohorts, but as these cohorts do not cover the period of the crime drop they are not relevant to this discussion.

decline in men's offending also using Swedish convictions data. Using victimization data, there is also some evidence of a declining gender gap in violent offending in the USA (Lauritsen et al. 2009), although different analysis of the same data did not reproduce this result (Schwartz et al., 2009). Whilst there is not complete consensus between studies, as a whole these findings illustrate that men and women have shown different trends in offending and conviction over the crime drop. This should be accounted for by studies of the age-crime curve over the crime drop as analysis of age-crime curves which are not disaggregated by sex may obscure different patterns of change between men and women. Moreover, it may be that the declining gender gap in offending as described above may reflect different patterns of change for young men and women and older men and women. Analysing change in the age-crime curve over the course of the crime drop for men and women separately can therefore help to refine our understanding of both the declining gender gap in offending and change in the age-crime curve.

A third limitation of these contemporary accounts of the age-crime curve is that each of these studies, with the exception of Morgan (2014), examines the age-crime curve using widely dispersed time points[17], analysing change in age-crime curves typically in five or ten year increments. The use of disparate time points has been typical in analyses of the age-crime curve. In the context of the 'great debate' this focus on widely varying time points was understandable. Gottfredson and Hirschi (1990:133) believed that subtle change in the age-crime curve was meaningless compared to the "stability of [its] major parameters" (Hirschi and Gottfredson, 1983:572). For those interested in asserting that the age-crime curve was variant, it made sense to focus on maximising temporal variation in the age-crime curve to demonstrate that the distribution does change over a sufficiently long time span (see Ulmer and Steffensmeier, 2014). But when the aim is to describe patterns of change in the age-crime curve over the crime drop, this selection of disparate time points entails discarding potentially useful information. Comparing the results of Farrell et al. (2015) and Ulmer and Steffensmeier (2014) provides an illustration. Farrell and colleagues analyse age-crime curves for homicide in 1980, 1993 and 2010, whilst Ulmer and Steffensmeier describe the Percentage Age Involvement, an alternative measure of the age-crime curve (see Steffensmeier et al., 1989), for homicide for

17 A list of studies and time-points analysed are presented in Appendix One.

1940, 1980 and 2010. Farrell et al.'s analysis shows an increase in homicide arrests at age 18 from 25 per 100,000 in 1980, to 50 per 100,000 in 1993 and then to 15 per 100,000 in 2010 – a dramatic rise and then fall between 1980 and 2010. Farrell and colleagues also found that homicide arrest rates for those age 25 and above decline between 1980 and 1993 and then again between 1993 and 2010 showing a contrasting trend to rates for younger people. This substantial change is hidden in Ulmer and Steffensmeier's analysis because of their selection of time points. By the same principle, analysing annual change in the age-crime curve allows more nuanced trends in the distribution to be identified, but has not been adopted by studies of the age-crime curve over the crime drop. Morgan (2014) illustrates the value of examining annual change in patterns of age and crime by linking the sharp falls in convictions and cautions served to men aged 11-20 seen from 2007 to changes in recording practices which occurred at that time. Analysis of annual change therefore allows the comparison of change in the age-crime curve with policy changes that may have influenced observed trends. As is discussed in Chapter Three, comparing change in dimensions of criminal careers with policy change in Scotland is a key aim of this thesis, making the analysing of annual change in the age-crime curve particular important in this study.

Lessons from the study of the age-crime curve

The focus on variation over time in previous analyses of the age-crime curve provides a helpful illustration of how temporal change in criminal careers concepts can be explored. Four key insights from the studies of the age-crime curve discussed above inform the current thesis: first, the need to analyse annual change in the age crime curve; second, the importance of differences in this change between men and women; third the need to analyse differences across crime type; finally, the predominant US focus of studies of change in the age-crime curve over the course of the crime drop, combined with the questionable capacity to generalize results from the USA to the European context, emphasise the value of analysing change in the age-crime curve in Scotland.

These lessons drawn from previous analysis of change in the age-crime curve can also inform the use of other dimensions of criminal careers as examined in this thesis. It is to the second of these dimensions, prevalence and frequency, that this

chapter now turns.

2.3 Prevalence and Frequency

Prevalence and frequency are concepts that were advocated by the criminal careers researchers as being of central importance to understanding the age-crime curve (Blumstein et al. 1986). In the most straightforward definition, prevalence and frequency distinguish between the proportion of people who offend (prevalence[18]) and the rate at which those who do offend commit crime (frequency). This distinction raises the question for the study of criminal careers and the crime drop: does the crime drop reflect fewer people offending, people offending less, or some combination of the two (Berg et al. 2016)? This section describes the initial controversy surrounding prevalence and frequency during the 'great debate', and argues that this controversy once again stems from the focus of those involved upon the causes of offending at the individual level. This section then discusses the use of prevalence and frequency to understand the crime drop and drawing lessons from this previous research into how prevalence and frequency can be used in the current thesis.

Prevalence and frequency in the great debate

For Blumstein and colleagues the distinction between prevalence and frequency was vital to the criminal career paradigm, to the extent that frequency was referred to in shorthand by using the Greek letter lambda (λ)[19]. The distinction between these two parameters permeated every aspect of the criminal careers paradigm. Proponents of the criminal careers approach contended that the two parameters might have different correlates (Blumstein et al. 1986), advocating for the empirical analysis of whether this contention bore out. It was also argued that the distinctive aggregate age-crime curve was primarily a function of prevalence rather than frequency (Farrington 1986), as frequency of offending was consistent for 'active' offenders during their criminal careers (Blumstein and Cohen 1987)[20]. The distinction between prevalence and frequency also had important implications for policy, and

18 Criminal careers researchers also use "participation" to refer to the proportion of people who offend (Blumstein et al. 1988:3).
19 The term 'frequency' is preferred throughout this thesis for the sake of clarity.
20 More recent evidence regarding whether frequency is constant for active offenders is equivocal (Piquero et al. 2003:436)

particularly the appropriate length of sentence due for particular offenders (Blumstein et al. 1986); it was argued that incarcerating those whose criminal careers had 'terminated' was an inefficient use of resources. Consequently key tasks for criminal careers researchers were estimating the frequency of offending (lambda) and lengths of criminal careers.

This distinction between prevalence and frequency proved controversial, however, with Gottfredson and Hirschi (1987) writing a rejoinder to Blumstein and colleagues rather caustically titled "The True Value of Lambda Appears to be Zero". In contrast to the criminal careers researchers, Gottfredson and Hirschi (1987) contended the causal factors related to prevalence and frequency are the same. As such, distinguishing between prevalence and frequency of offending did little to help identify the causes of crime and so this distinction was of little value. Gottfredson and Hirschi (1987) suggested that lambda's only possible value was in connecting the prevalence of offending with the overall offending rate. Blumstein et al. (1988a) bluntly disagreed, arguing that prevalence and frequency were themselves the factors of interest rather than the aggregate crime rate. The justification for their disagreement is telling, stating that "Because the aggregate [crime] rate inextricably combines [prevalence and frequency], its analytical usefulness is limited for exploring the nature of individual criminality, *which is the subject of research on criminal careers*" (1988a:4, emphasis added). Here both sides of the debate are again focusing on micro-criminological concerns. As a result, Gottfredson and Hirschi's (1987) critique of the distinction between prevalence and frequency loses traction when the aim of the analysis is not to examine the causes of crime at the individual level but on aggregate crime rates, as in this thesis, the distinction between prevalence and frequency is valuable because together these two measures can describe aggregate crime rates; changes in aggregate crime rates must necessarily reflect the mix of changes in both prevalence and frequency, as well as change in the age structure of the population (Blumstein et al. 1988a:16, footnote 16). Indeed, aggregate crime rates can be fully described as a function of prevalence and frequency[21] (Blumstein et al. 1988a:4). However, perhaps due to the individual-

21 This focus uses an aggregate measure of frequency (the average number of convictions per person convicted in a given time period), as opposed to an individual level measure (the rate of convictions for a particular person in a given time period). The focus here is on the former, as this provides the a direct link between prevalence and the overall volume of convictions Indeed, Gottfredson and Hirschi contend that this is the only possible value of measuring the frequency of offending (1986:229-230, footnote 4).

level focus of the criminal careers paradigm, it was only recently that prevalence and frequency have been used to explore change in aggregate crime rates (Berg et al. 2016), and thus utilise these criminal careers parameters for macro-criminological concerns.

Using Prevalence and Frequency to Explore Change Over Time

Berg et al. (2016) use the distinction between prevalence and frequency to argue that splitting overall declines in crime into change due to prevalence and change due to frequency can be a useful way to understand overall change in crime rates. This distinction allows description of the "anatomy" of the crime drop in a way that aggregate analyses, which conflate the effects of prevalence and frequency, cannot (Berg et al. 2016). Understanding the anatomy of the crime drop is important for two reasons. First, differences in prevalence and frequency can be important in understanding the potential causes of changes in crime rates, as different theories of offending and of the crime drop may have different mechanisms which would be expected to work through either prevalence or frequency (Berg et al. 2016). This is a subject discussed in greater detail in Chapter Three in regards to particular theories of the crime drop. Second, a crime drop driven prevalence would require different responses from the justice system than one driven by frequency. Blumstein et al. (1988a:7) suggest that reducing crime through lower prevalence would "relate to a general social policy of developing prevention strategies directed at the total population", whilst reducing crime through lower frequency "relates more narrowly to the identification of effective treatment or control alternatives for those who have begun to commit crimes".

Despite this value there has been little empirical work to date in analysing changes in prevalence and frequency over the course of the crime drop[22]. To the author's knowledge, Berg et al.'s study is the only one consider such change is that of Berg et al. (2016). Berg et al. empirically explore change in prevalence and frequency using data from two waves of self-reported offending data in the Pittsburgh Youth Study, and their results show that there have been reductions in the prevalence and frequency of property crime, but serious violence saw declines in prevalence but not

22 Farrell et al. (2015) surmise that falls in crime for young people are likely to be due to lower prevalence rather than lower frequency, given that the age-crime curve typically reflects prevalence rather than frequency. However, they do not empirically assess whether this is the case.

frequency. For drugs offences they found no decline in prevalence or frequency between the two cohorts. These results suggest that both prevalence and frequency may be important in reducing overall crime rates, and also emphasise the importance of considering trends for different crime types. Whilst an important reference point for the current study, there are limitations to Berg et al.'s (2016) account of change in prevalence and frequency. As their analysis is based on the Pittsburgh Youth Study, the results relate only to young men aged 17-18 in 1992-1993 and 1998-1999. Their results are therefore limited in its generalizability across both age and sex. Moreover, the account of Berg et al. (2016) only considers two of the three potential contributions to overall crime rates suggested by Blumstein et al. (1988), ignoring the potential confounding factor of change in population structure. Given the scope of the data used by Berg et al. (2016), no inferences can be drawn about change in prevalence and frequency after 1999. This raises the question of how prevalence and frequency have changed in more recent years. Finally, as with the recent analysis of change in the age-crime curve as discussed above, Berg et al. (2016) focus only on data from the USA. There is therefore value in examining the interaction between prevalence and frequency over the course of the crime drop in a different jurisdiction, given the questions regarding the capacity to generalize findings from studies of the crime drop in the USA to Europe.

Lessons from the study of prevalence and frequency

Analysing change in prevalence and frequency is an important, but mostly ignored, descriptive task necessary to understand the crime drop, but understanding whether falls in crime are due to to fewer people offending, due to people offending less, or to a combination of the two. Understanding these trends can help refine theories of the crime drop. Whilst the analysis of Berg et al. (2016) is a helpful starting point to understand change in prevalence and frequency over the course of the crime drop, little is known about how trends in prevalence and frequency have changed for women, for men above the age of 18, after 1999, or outside of the USA. These are similar gaps to those identified in contemporary studies of the age-crime curve in Section 2.2, and are areas which are addressed by the current thesis.

2.4 Polarisation

The third criminal careers concept investigated in this thesis is the "polarisation" of offending (Balvig 2007:13). This is a term which, to the author's knowledge, is not widely used in the discussion of criminal careers, but is one of importance to this study as it focuses on change over time in one of the central observations of the criminal careers literature; that there are a small number of high-rate offenders who contribute a disproportionate amount to overall crime rates (Wolfgang et al. 1972, Gottfredson and Hirschi 1986)[23]. This observation has been so consistent that it was described by Weisburd as being of "universal validity" in criminology (2015:149). In essence, polarisation describes a situation where offending is increasingly concentrated in a small number of high-rate offenders, due to falls in the numbers of low-rate offenders (Balvig 2007). This idea is important for this thesis because it is possible that the crime drop may be reflected in falling offending for some groups of offenders but not others. In particular, falling crime rates over the course of the crime drop may represent a change in the mix of high-rate offenders in the population (Farrell et al. 2015, Owen and Cooper 2013). For example, in the study which led Balvig (2007) to coin the term, the proportion of young people who had not offended at all increased between survey waves from 1989 to 2005, but the proportion of people who committed serious offences remained consistent but the number of offences committed by the 'criminal' group increased. The increase in non-offenders in Balvig's study came from a falling proportion of low-level offenders, with the proportion of high-level offenders unchanged in their study. Balvig defined this high-level group as a combination of those "who have once or twice committed relatively serious theft, i.e., burglary, car theft and/or robbery" and those "who have three times or more committed relatively serious theft, i.e., burglary, car theft and/or robbery" (2007:7). Precisely how (and whether) to identify and classify people as high-level offenders has been an area of significant debate in the criminal careers literature on both conceptual and methodological grounds (Gottfredson and Hirschi 1986), even though the idea that a small number of people are responsible for large proportion of overall crime is widely accepted (Sampson

23 Such a group is variously referred to as 'persistent offenders', 'chronic offenders', or 'career criminals'. The term 'high-rate' is used here for sake of consistency, and to emphasise that the focus of this analysis is on observed patterns of convictions. The terms 'chronic' and 'persistent' imply both rate of offending and duration of offending. The time-scales used to refer to high-rate offenders as operationalised in this analysis are discussed in Section 5.4. Analysis of pathways of conviction provides a further indication of stability of people's classification as high-rate offenders over time (see Section 2.5).

and Laub 2005). Before considering other research into how the mix of high-rate and low-rate offenders has changed over the course of the crime drop, it is therefore necessary to understand the conceptual and methodological debates around the identification of such a group. The following section discusses these debates and proposes that when interpreted correctly, statistical methods – specifically Latent Class Analysis (LCA) – provide the most suitable way to classify people into different conviction groups. Following this discussion, this section then covers existing analyses of polarisation over the course of the crime drop. How exactly the concept is operationalized in this thesis is discussed in Chapter Four.

Conceptualizing high-rate offenders

The criticism of the concept of the persistent offender has primarily related to whether this group have distinct causes of offending, and whether they can be identified before they have committed a large number of offences (Sampson and Laub 2005). For those who contend that the causes of offending are general, there is no theoretical reason to distinguish between groups of offenders, such as 'career criminals' and other kinds of offenders (Gottfredson and Hirschi 1990). In its simplest terms, this is a criticism of the conception of chronic offenders as being different types of people to other people who offend (Skardhamar 2009). Others who propose taxonomic accounts of offending suggest that there are distinct kinds of offender, including high-rate offenders, whose offending has different causes to other types of offender (notably Moffitt 1993, also Thornberry and Krohn 2005). These criticisms, and particularly those of Gottfredson and Hirschi (1988), are bound up with policy concerns; policies which target chronic offenders, particularly selective incapacitation (Blumstein et al. 1986), can only be effective if such a group can be reliably identified *before* they commit a large number of offences.

In this thesis, the investigation of polarisation and the necessity to identify a group of high-rate offenders does not entail the assumption of a distinct aetiology for this group. Rather than looking for changes in the causes of offending over time, the concept of polarisation is used here as a short-hand way of examining change in the distribution of offending amongst those who offend. This provides another way, in addition to the discussion of prevalence and frequency (see Section 2.3), to assess whether falls in conviction rates are disproportionately related to high-frequency

offenders, or whether they are spread evenly across the population who offend. Similarly, the identification of such a group in this thesis is not associated with the recommendation of a policy of selective incapacitation. These two criticisms of concepts of persistent offenders are therefore not relevant to the results of this thesis. However, there is still a conceptual problem associated with the identification of 'chronic' or 'persistent' offenders; that any cut-point used to identify such a group is arbitrary (Nagin 2004). When determining between categories of offender, it is also necessary to determine the criteria by which any categories are defined. Often such categories are based on the volume of offending, but categorization can also involve grouping people together based on similarities in the type of crime committed (Francis et al. 2004b). These are issues which have been much-discussed in the criminological literature, and which are reviewed below.

Identifying high-rate offenders

Often the distinction is made between a high-rate offender and other offenders by specifying a number of offences a person has to have committed within a particular time frame[24]. The central problem involved in identifying high-rate offenders in that way is that the adoption of different criteria to determine groups of offender leads to different people being identified as persistent (Hagell and Newburn 1994). A popular way to circumvent this problem has been to identify high-rate or persistent offenders statistically using latent class models[25] (McCutcheon 1987, Nagin and Land 1993). Latent class models are a group of statistical models which can construct groups out of offending data based on people's conviction patterns, but without having to specify cut-points between groups *ex ante* (Nagin 2004). Instead, the grouping of people into different classes is based on the data itself, with specification of the different groups being determined by the fit of these groups to the observed data (Vermunt and Magidson 2002).

The most popular specification of latent class models to identify high-rate offenders has been the latent class growth curve model (Sampson and Laub 2005), which

24 For example, Owen and Cooper define chronic offenders as those with "15 or more re-offences over the follow- up period" (2013:8).

25 When used to identify high-rate offenders the latent class methods used are typically trajectory methods, and in particular latent class growth curve analysis (LCGA), although the latent class framework covers a number of different methods. Much of the following discussion relates to LCGA, but many issues of interpretation are common across different types of latent class models.

groups people together based on different trajectories of offending, typically specified by the person's rate of offending in a given period. Since their introduction to criminology by Nagin and Land (1993), latent class growth curve models have been wildly popular. Jennings and Reingle (2012) provide a review of the findings of 105 studies which analysed latent trajectories of violence, aggression and delinquency. These studies produced between two and seven classes of offender, with most studies finding three or four classes, typically including a 'chronic' group as well as a group of non-offenders and a group of either increasing or decreasing levels of violence, aggression or delinquency. Based on this review Jennings and Reingle (2012) conclude that any future studies of latent class growth curves are likely to produce groups in accordance with these patterns. Analyses of convictions data using other kinds of latent class methods, such as Latent Class Analysis (LCA) have also produced groups of offenders marked by a high frequency of conviction (Elliott, Francis and Blokland 2014). This suggests that latent class models are likely to identify at least one group of high-rate offenders, making them suitable as a tool to identify 'chronic' offenders, even though the number and form of the groups select is dependent on the features particular dataset being used[26].

Interpreting latent class models

Despite its popularity, the use and interpretation of latent class models has generated a number of misconceptions (Nagin and Tremblay 2005) and controversy (Sampson and Laub 2005, Skardhamar 2010a)[27]. This controversy and confusion stemmed in part from the different ways in which model results can be interpreted. In the simplest terms, there are two ways to interpret the classifications made by latent class models: direct and indirect interpretations (Bauer 2007:779, citing Titterington, Smith, and Makov 1985). Direct interpretations see classifications produced by latent class models as real groups. In contrast, indirect interpretations see them as a only a statistical summary of the population.

An example of a direct interpretation comes from the use of latent class models to support taxonomic theories of offending. For example, Moffitt's (1993) taxonomic

26 The groups identified can be influenced by the number of time points, the spacing of time points and the covariates included in the model (Eggleston et al. 2004).

27 Again, Sampson and Laub's (2005) discussion relates particularly to latent class growth analysis, but the features described here are general to latent class models.

theory of offending, which sees the offending population as consisting of two "qualitatively distinct" (1993:674) groups: Adolescent Limited offenders and Life-Course Persistent offenders. The use of latent class trajectory models is "designed to test for the existence of the sorts of distinctive offending trajectories predicted by Moffitt's [taxonomic] theory" (Nagin and Land 1993:328-329, see also Sampson and Laub 2005). The presence of a "late bloomer" group in Krohn et al.'s (2013:194) account of interactional theory of offending provides another example of a direct interpretation of a latent class model. In this case the causal mechanisms which are hypothesised to make this group theoretically distinct from other offending groups were theorized *after* the group was empirically identified by a latent class model (Krohn et al. 2013). The latent class model produced a trajectory which was understood as representing a distinct phenomenon in the real world that had to be understood.

More in line with an indirect interpretation of latent class models, Skardhamar (2009, 2010a) notes that the results of latent class growth curve models may also be comparable with general theories which do not consider groups identified to have different causes (Osgood and Rowe 1994). Within this approach, groups identified represent an approximation for an underlying, unknown continuous distribution (Nagin and Tremblay 2005)[28], with groups merely representing 'heuristic devices' or summaries of this unknown underlying distribution. With this interpretation, latent class methods can still usefully be used descriptively for data reduction (Skardhamar 2010a:314), providing a methodological tool to counter the arbitrariness of selecting cut-points between different types of offenders (Nagin 2004) but not as a way of implying that those classified into different groups are distinct 'types' of offender.

Crucially, there is nothing in a latent class model itself that can determine between real groups and points of support on a continuous distribution, as the problem is "epistemological rather than methodological" (Hope and Norris 2012:550). The interpretation given to a particular model depends on the purpose to which the model is put (Pickles and Angold 2003) and the substantive knowledge of the researcher. In the context of describing the polarisation of offending, an indirect

28 It is Nagin's adoption of both direct (Nagin and Land 1993) and indirect (Nagin and Tremblay 2005) interpretations at different points which led Sampson and Laub (2005:909) to suggest that Nagin is "having his cake and eating it too".

interpretation is preferred; the aim of latent class methods in this context is merely to summarize the distribution of offences amongst offenders, rather than to distinguish a group with distinct causes of offending. Given the uncertainties regarding the interpretation of latent classes as 'real' groups (Sampson and Laub 2005, Skardhamar 2009), to read the results of a latent class analysis as reflecting theoretically distinct groups of offenders would be an inappropriate assumption. This makes the use of latent class models in this thesis akin to what Skardhamar (2010b:11) terms a "classification system", with a primarily *empirical* and descriptive purpose, as opposed to a "typology" which has a primarily theoretical purpose.

Analysing latent classes: data handling and research design

As well as issues regarding interpretation, there are also practical issues arising from the use of latent class methods that can affect the results observed. First, the way that data are manipulated affects classes produced. Eggleston et al. (2004) suggest a number of factors which can affect the groups identified when using latent classes to identify trajectories of overall offending, such as time spent in prison and attrition due to cohort mortality. Where possible, these factors should be controlled for.

Second, how gender differences are modelled is an important consideration when specifying a latent class model. For example, Odgers et al. (2008) compared trajectories of offending in the Dunedin longitudinal study, estimating latent classes first on data for men and women combined and then using data for men and women separately. The analysis identified a consistently high-rate offending group of offenders using both methods, but the proportion of women in the high-rate class was higher when the data were analysed separately than when it was analysed together (7.5% to 5%). This represents a threshold effect rather than a gender effect *per se*, as these results show that the definition of the classes estimated changed based on the data included in the model, and in particular altered the properties of the high-rate class – the high-rate class when estimated on data from women only had a lower offending rate than the high-rate class when estimated on data from men and women. These results suggest that latent class methods will still identify women as high-rate offenders, but at a lower rate rate when latent classes are estimated using mixed-sex samples rather than same-sex samples. This emphasises

that in this context the groups produced by latent class models are best understood as summaries of the data.

Third, the type of data analysed can also affect the trajectories identified. Particularly, trajectories estimated on convictions data not equating directly to trajectories of offending. This is as much a substantive issue as a methodological one; analysing data from the Edinburgh Study of Youth Transitions and Crime, McAra and McVie (2010a) demonstrate that latent trajectories identified based on convictions did not align with patterns of self-reported offending. The latent class growth curve model employed identified two early-onset groups based on convictions data, one of 'desisters' and one of 'persisters', but found no difference between the groups in self-reported offending. These results caution against inferring that trajectories identified based on convictions data directly reflect offending. As is ever the case when working with offending data (Gottfredson and Hirschi 1986:230), these results emphasise that the type of data used is crucial to the inferences that can be made from latent class models.

Fourth, whether the outcome measure is a count of total convictions or divided into different types of crime affects the use of latent class models. Francis et al. (2004b) argued that the outcome measure of latent class trajectory models is imprecise because such trajectories can conceal differences between patterns of offending of different types. This can be seen as a statement about the way that typologies of offender are conceptualised. To focus only on the volume of offending makes the assumption that differences between different crime types are not relevant to the conceptual distinction between offenders (Francis et al. 2004b). Given the importance of different crime types showing different trends over the course of the crime drop (Aebi and Linde 2010, see also discussion in Chapter Three), for this study accounting for potential differences in rates of conviction for different crime types is an important factor to consider when constructing latent conviction groups when analysing polarisation. As a result, Francis et al. (2004b) preferred latent class analysis to latent class growth curve analysis in order to account for people receiving convictions for different types of crime. This type of latent class method can also be extended to consider the frequency of conviction as well as type (Elliott, Francis and Blokland 2014). Consequently the same method is adopted here, with details of this

method discussed in Chapter Five.

In sum, when the idiosyncrasies of the method are accounted for, latent class methods present an appropriate way to identify a group of 'chronic' offenders whilst avoiding arbitrariness often encountered in determining such a group (Nagin 2004), and so can be a suitable way to examine the polarisation of the population who offend. In doing so, it must be remembered that the groups identified are intended as a statistical summary of the data and are contingent on the way the data are manipulated prior to the analysis. This established, the focus of this discussion can now move to existing studies of polarisation of offending over the course of the crime drop.

Studies of polarisation over the course of the crime drop

With the exception of Balvig (2007), no other studies have explicitly investigated the polarisation of offending over the course of the crime drop. However, a number of researchers have described changes in the frequency or seriousness of offending over time. The results of existing studies which have examined changes in the proportion of frequency or serious offenders over the crime drop are summarized in Table 2.1[29]. It should be noted that each study adopts its own definition of persistent offender. Of these studies only one, that of Soothill et al. (2008), has adopted latent class methods. Soothill and colleagues use latent class analysis (LCA) to divide those convicted in England and Wales into different groups based on variety of crime types for which they were convicted. Whilst methodologically related, this analysis has a different aim from those of the studies of trajectories of offending discussed above, focusing on combinations of different offending types, rather than on the rate of total convictions. Despite this different aim, the 'versatile' group identified in this study can be considered somewhat analogous to a high-rate offending group[30]. The other studies listed in Table 2.1 all use the number of offences committed or the seriousness of offences committed to distinguish between serious offenders and

29 Many of these studies also included comparison of cohorts prior to the 1990s crime drop. These cohorts are not represented in the summary of results presented here. Selecting only these cohorts leads to conclusions different to those of the original authors; for example, Soothill et al. (2008) report an *increasing* membership of the versatile convictions class over the whole study period, but the proportion in this class is lower in the youngest cohort than the second-youngest.

30 This is based on two observations: One, being convicted for multiple different crime types requires receiving multiple convictions; two, most offenders only receive a single conviction (see Chapter Four).

Table 2.1 Summary of existing studies examining change in persistent offending over the course of the crime drop

Study	Measure of high-rate offending	Range of data	Results	Polarisation
von Hofer (2014)	People with at least four convictions as a proportion of those with any conviction	Swedish birth cohorts from 1968 and 1978, and followed up to age 30	Men: 15.6% in 1968, 18.1% in 1978 Women: 4.6% in 1968, 5.8% in 1978	Increasing
Bäckman et al. (2014)	Men and women with at least four convictions as a proportion of those with any conviction	Two cohorts born in Sweden 1975, 1985 between the ages of 15 and 19	Men: 8.4% in 1975, 7.8% in 1985 Women 2.0% in 1975, 1.6% n 1985	Decreasing
Soothill et al. (2008)	Latent class analysis of conviction types (versatile class taken to represent high-rate class)	Comparison of cohorts born in 1973 and 1978 between age 16-20	Men 30.1% in 1973 cohort to 28.7% in 1978 cohort Women: 15.9% in 1973 cohort to 15.5% in 1978 cohort	Decreasing (men), little change (women)
Soothill et al. (2003)	"Three separate sentencing occasions within eight years taking place in England and Wales, and then another sentencing occasion within three years of the last." (2003:392).	Comparison of cohorts born in 1973 and 1978 between age 10-21	Men: 24.5% in 1973 cohort, 21.9% in 1978 cohort* Women: 11.6% in 1973 cohort, 11.5% in 1978 cohort*	Decreasing (men), little change (women)
Balvig (2007)	Proportion of those reporting any offending with at least one offence of "relatively serious theft, i.e., burglary, car theft and/or robbery"	Self-report offending by 14 and 15 year old school children in Denmark in 1989, 1999 and 2005	11.6% in 1989 cohort, 10.3% in 1999 cohort, 13.7% in 2005 cohort	Decrease then increase
Svensson and Ring (2007)	Proportion committing 36 or more offences	Self-reported offending by 15 year-olds in Sweden between 1995 and 2005	9.8% in 1995 cohort, 6.1% in 2005 cohort	Decreasing
Owen and Cooper (2013)	"15 or more re-offences over the follow- up period" (2013:8)	People first cautioned or convicted in 2001 and 2005, followed up to 2010	2.6% in 2001 cohort, 2.2% in 2005 cohort	Decreasing

Note: Result shows high-rate offenders as a proportion of all offenders. Calculations are author's own unless otherwise indicated by *.

other offenders. These different measures explain the wide range of estimates of polarisation produced by these different studies (from a low of 2.2% to a high of 30.1%).

Taken together, the work summarised in Table 2.1 suggests two main conclusions for the study of polarisation over the course of the crime drop. First, the majority of these studies show a falling proportion of high-rate offenders over the course of the crime drop. The exceptions to this trend are the analyses of Balvig (2007) and Von Hofer (2014) which show increasing polarisation. Balvig's study is quite small[31], meaning that results may be influenced by sampling variation. Von Hofer's (2014) study is the only one of those considered which followed a cohort beyond the early twenties[32]. One explanation for this discrepancy may be differences in trends across age, similar to the observations of Farrell et al. (2015) and Kim et al. (2015). Consequently, examining trends in polarisation for different age groups will help to assess whether this is a plausible explanation for these differences in results. Second, studies which examine differences between men and women show greater falls in polarisation for men than for women. Similar to the observation of a falling gender gap in crime as discussed in Section 2.3, this indicates the value of examining change in polarisation separately for men and women.

Limitations of studies examining polarisation

Despite the value of the studies listed in Table 2.1 as providing an initial indication of how the composition of the population of offenders has changed over the course of the crime drop, these studies have three primary limitations. First, with the exception of Soothill et al. (2008) these studies can be considered limited by their reliance on arbitrary cut-points between persistent offenders and other offenders and their focus only on the volume of offending. Such taxonomies may obscure important differences between people with different frequencies of offending across multiple crime types (Francis et al. 2004b:50). Identifying different groups of offenders using latent class methods can help with this data reduction (Skardhamar 2010a) whilst avoiding arbitrariness (Nagin 2004). Latent class analysis, being able

31 In Balvig's analysis the numbers of people classified into the "Recidivist" group is approximately 29 in 1999 and 30 in 2005. These numbers are based on the author's own calculations from figures listed in Balvig (2007:9).

32 Owen and Cooper (2013) form cohorts of those convicted in a given year, and so these cohorts will include a wide range of ages.

to model differences in both frequency and type of crime (Elliott, Francis and Blokland 2014), therefore provides a more suitable method than latent trajectory analysis by which to differentiate between different groups of offender based on their conviction patterns, because latent trajectory models are typically restricted to modelling convictions of all crime types together. Second, as discussed above, the focus of many of these studies on a narrow age range makes them of limited use to trends in polarisation for the population as a whole. Third, there is a strong Scandinavian focus in these studies, with the exception of Soothill et al. (2008) and Owen and Cooper (2013). Again, this is not in itself a limitation, but does suggest the value of examining these trends in different countries to assess whether results observed are similar to those in Scandinavia.

Lessons from research into the polarisation of offending

From this review of research into polarisation, it has been shown that examining change in the prevalence of persistent offenders provides a potentially useful lens through which to assess change in patterns of crime over time. Latent class methods provide a suitable methodological tool to distinguish between high-rate offenders and other members of the population of those who offend without implying a particular taxonomic theory of offending. Still, care must be taken to interpret the results of these models appropriately, given the ease with which groups identified can be inappropriately interpreted. Previous empirical results using latent class methods show that high-rate offending classes are likely to be identified for both men and women. Results which have focused on separating out groups of offenders based on the number of convictions committed have provided conflicting evidence as to whether the prevalence of high-rate offenders has increased over the course of the crime drop. This suggests the value of further analysing polarisation in a different context.

2.5 Pathways

Having discussed the age-crime curve, prevalence and frequency and polarisation, there is one other concept from criminal careers research that is particularly relevant for this analysis: that of pathways of offending.

Defining 'pathways' of crime

The concept of pathways of crime returns to Blumstein et al.'s (1986:12) definition of criminal careers as relating to the longitudinal sequence of individual offending. In its simplest form, the concept of a pathway relates to how a person's pattern of offending changes over their lives. The terminology of pathways is used by Francis et al. (2004b) who describe a person's movement between different offender categories in different age periods as 'pathways'. This basic idea of describing the development of a person's offending or conviction patterns over time is a common one in criminal careers research. The term pathway is employed by Francis et al. (2004b:49) because of the flexibility it implies, as "anyone on one pathway can take another route on a different pathway"[33].

This contrasts this terminology with that adopted by Sampson (2015:277), who conceives of long-term patterns as 'trajectories'[34], short term events within trajectories as 'transitions' (for example, getting married), and transitions which lead to changes in trajectories as 'turning points'. In this sense, trajectories and pathways of crime are conceptually very similar. The term pathway is preferred here to avoid the association with the particular method latent trajectory analysis (see discussion in Section 2.3). A further distinction between the idea of a pathway as used here and Sampson's (2015) focus on trajectories, transitions and turning points is that the term 'pathway' is used purely descriptively, without implying a particular salient life event which may have influenced the development of a person's offending history at a given time. This is in line with Francis et al.'s (2004b) use of the term. When used in this thesis, the term 'transition' is used as equivalent to that of 'pathway'; acting as a description of convictions patterns in adjacent time points, rather than between important life events.

The flexibility of this concept of conviction pathways incorporates a number of

33 This usage is almost opposite from that of Skardhamar (2010:41, citing Moffitt 1993) who links the term "pathway" to a developmental conception of offending, with the "pathway" referring to a set of fixed, developmental stages. Skardhamar contrasts the developmental approach, and the idea of a pathway, with a life-course perspective and a focus on "chains of interlinked events". As used here the term "pathway" is not used to imply either the development or life-course theoretical approaches discussed by Skardhamar, only in the descriptive sense employed by Francis et al. (2004b:49).

34 The term "pathway" was also used in early work by Sampson and Laub (1993), and it is from this early work that Francis et al. (2004b) derive the term. This indicates that the concept of the trajectory and the concept of pathway are very similar.

different criminal career parameters. As used by Francis et al. (2004b), the movement between different conviction and no-conviction groups over time naturally incorporates persistence and desistance. Again, it should be noted that in this context these terms are used descriptively. For example, elsewhere in the criminological literature, the term 'desistance' has a particular meaning, in part relating to the process of change which leads a person to stop offending (see for example Gadd and Farrall 2004). This is not the sense in which the term is employed by Francis et al. (2004b), who use the term only to describe a period in which a person does not have a conviction. It is in this latter sense that the term desistance is used here.

Measuring pathways of crime

The concept of pathways of crime as adopted by Francis et al. (2004b) is closely related to issues of measurement. The modelling approach adopted by Francis et al. (2004b) is to divide each person's criminal career into age bands of equivalent length (five years), classify each of these age-bands as reflecting a particular offender class, and then examine people's movement between these classes over time. In contrast, the latent trajectory approach (as in Nagin and Land 1993), classifies the whole of a person's criminal career into a single trajectory. Describing the movement between conviction classes at different times can be done via simple cross-tabs (Francis et al. 2004b) or via a statistical model such as a hidden Markov chain (Bartolucci et al. 2007) or a latent transition model (Nylund 2007). With Francis et al.'s (2004) cross-tab approach, LCA is used to estimate membership of convictions groups at different times. The benefit of this approach to modelling pathways, as opposed to the latent trajectory approach described in Section 2.3, is that LCA can classify people together based on patterns of conviction for different types of crime, rather than using counts of total convictions as is typical with latent trajectory analysis[35]. This allows more dynamism in this classification (Francis et al. 2004b) as opposed to summarizing a person's whole offending history as belonging to a particular trajectory.

35 It is possible but uncommon to estimate trajectory models with more than one latent dependent variable (Seddig 2013)

The importance of changing pathways of crime

Similar to the other criminal careers concepts discussed in this chapter, change in pathways of crime can help to understand the crime drop. This point is made by Blumstein et al. (1986:2) and also more recently by Farrell et al. (2015), who note that changes in aggregate crime rates may reflect changes in persistence and desistance in crime in the same way that it can reflect prevalence and frequency (Berg et al. 2016). In particular, and again drawing on Moffitt's (1993) dual taxonomy theory, Farrell et al. (2015) contend that falling crime rates reflect a lower prevalence of 'Adolescent Limited' offenders in the population. In earlier work Farrell et al. (2011:168) make this point more generally; falling crime rates may reflect greater rates of desistance amongst active offenders, as well as fewer people beginning criminal careers. Analysing change in pathways of offending drawing on different categories of offending can therefore help to assess whether changes in offending patterns are general or specific to different groups.

To the author's knowledge there have not been any previous studies of change in pathways of offending over the crime drop. In describing the theoretical relationship between desistance, persistence and the crime drop Farrell et al. (2015) rely on aggregate analysis of the cross-sectional age-crime curve. This is not well suited to examining changes in pathways of crime for exactly the reasons identified by the 1986 Criminal Careers report; the cross-sectional perspective cannot account for movement into and out of offending, such as potential late-onset offending (Krohn et al. 2013), or distinguish between the prevalence of different trajectories which, together, make up the age-crime curve.

Studying change in pathways of crime over the course of the crime drop is particularly important for developmental and life course criminology. Indeed, Sampson and Laub (2016:330) contend that "perhaps the biggest unstudied societal change for individual development is the great American crime decline". No single study is capable of providing a comprehensive understanding of how criminal careers have changed over the period of the crime drop (Sampson 2015:281). However, by describing change in pathways of crime can provide an important contribution to understanding how criminal careers have changed over the course of the crime drop, and in particular by comparing change across multiple cohorts. Such

analysis can both describe how pathways of crime have changed and whether these changes are most commensurate with period or cohort effects. Such an indication can indicate potential mechanisms which may have influenced the development of crime over people's lives (see Chapter Three), and whether the "societal change" manifest in falling crime rates has affected all ages or whether the crime drop reflects societal change concentrated in particular groups.

2.6 Justification for the selection of concepts

This chapter has argued for the use of criminal careers concepts as a way to understand changes in aggregate crime rates. In addition to the four concepts discussed here – the age-crime curve, prevalence and frequency, polarisation and pathways – there are a number of other dimensions of criminal careers which have been identified which could be adopted to examine changing patterns of offending over the course of the crime drop. These include specialization, intermittency (Baker et al. 2015), co-offending (Reiss 1988), and onset (Blumstein et al. 1986). The four factors discussed in this chapter are considered the most relevant to the study of criminal careers and the crime drop as they have the most direct relationship to the overall volume of offending. Whilst changes in co-offending may have an impact on overall crime rates, this would necessarily have to work through one of the parameters of each person's criminal career which relate to the volume of crime, such as those discussed above. Similarly, there seems little plausible theoretical reason that the crime drop would reflect change in the intermittency of conviction but not affect other dimensions of the criminal career as measured in this study, such as frequency and pathways of crime. As this thesis aims to explore falls in aggregate crime rates through the lens of criminal careers, it is the dimensions of the criminal career that focus most explicitly upon the volume of offending which are the most important.

Of those dimensions not analysed here, the most relevant to understanding the crime drop is onset (Farrell et al. 2015). To some extent, onset and prevalence of offending are related; it is not possible to offend without starting to offend. However, when discussed in the developmental literature, the issue of onset is often related to early onset offending (Moffitt 1993). It is questionable whether onset can be properly measured without childhood measures of offending (McGee and

Farrington 2010). Onset of *offending* cannot be examined in this study as the dataset used only contains information on convictions (see Chapter Four). Moreover, because of the way the justice system in Scotland operates, data in the Scottish Offenders Index only contains reliable information for convictions for those over the age of 16 (again, see Chapter Four). To some extent this is a limitation of the current study, and an area which it would be of benefit for future research to examine. However, this left-censoring of SOI reflects how the justice system in Scotland operates (see Section 4.3) and is a necessary consequence of the analysis of conviction data. Furthermore, understanding trends in the onset of conviction are important in their own right as measure of official reactions to crime, and how people are 'recruited' into the justice system (Soothill et al. 2004). The concepts discussed here, then, are not exhaustive in their application of criminal careers concepts to the study of the crime drop but do provide a way to look at the most important criminal career parameters which would be expected to affect the volume of crime committed.

2.7 Conclusion

This chapter has discussed four concepts from criminal careers research – the age-crime curve, prevalence and frequency, polarisation and pathways – which are most relevant to the task of understanding changes in crime over the course of the crime drop. These concepts provide a lens through which to better understand the development of the crime drop, as well as to further knowledge of how patterns of criminal careers change over time. Based on recent research into criminal careers there is some evidence of falling adolescent offending but increasing adult offending over the period of the crime drop, with important differences in trends for men and women. Analysis should consider differences between men and women across the full age distribution, and examine annual change across the parameters of interest. There is value in conducting this analysis in a jurisdiction other than the USA or Sweden, which have been the focus of the majority of previous analysis of change in different aspects of criminal careers over the course of the crime drop[36]. However the question of how criminal careers have changed over the course of the crime drop is one that has been largely unexplored.

36 Data availability is likely to explain this previous focus on the USA and Scandinavia, given scant number of datasets with sufficient scope of data to analyse change in patterns of crime with age over long time period (Steffensmeier et al. 1989).

To make the link between the research into criminal careers, as discussed here, and understandings of the crime drop, the following chapter describes the theories which have been hypothesised to explain the crime drop and relates these theories to the criminal careers concepts discussed above. The following chapter complements this analysis of explanations for the crime drop with discussion of trends in justice policy in Scotland over the period being examined. This discussion helps to contextualise the findings of the criminal careers research reviewed in this chapter, and sets the stage for this thesis to bridge these two bodies of work.

Chapter 3. Research context: the crime drop in Scotland

3.1 Introduction

This chapter aims to link the research into criminal careers discussed in Chapter Two to the literature examining explanations of the crime drop and to the Scottish context. The chapter begins by presenting an overview of research that has described falling trends in crime, first considering the international literature and then research examining the crime drop in Scotland. Comparison between international accounts of the crime drop and those in Scotland suggest that crime trends in Scotland are more similar to those in other Western European countries than those observed in America. Second, this chapter outlines how change in criminal careers can be related to theoretical accounts of the crime drop, arguing that descriptions of trends in criminal careers are best seen as a way to develop, rather than test, explanations of the crime drop. The chapter then discusses four explanations proposed for the crime drop – demographic change, the security hypothesis, the multifactor explanation and cultural change – and one potential confounding factor – the effects of changing justice policy and practice – and describes how these crime drop explanations mesh with the four criminal careers concepts discussed in Chapter Two. The fourth section of this chapter presents a brief history of justice policy change in Scotland over the period of the crime drop, and argues that three main policy periods identified in the literature are important turning points to consider when examining convictions trends. To further examine the potential effects of system change on conviction rates, this section also discusses trends in the use of non-court disposals in Scotland and how these may have affected convictions trends. The final section brings together the discussion of crime trends in Section 3.2 and justice policy in Section 3.5 to assess how distinctive Scotland can be considered as a case study of the crime drop and the generalizability of the results of this analysis.

3.2 What is the crime drop?

'Crime drop' is the term used to refer to falls in crime seen in a number of countries in North America, Australasia and Europe since the early 1990s. This drop has been

seen across a number of different measures, including recorded crime, victimization and conviction rates, and marked a reversal in a trend of increasing crime rates which had held in the USA and almost all Western European countries since the 1960s (van Dijk and Tseloni, 2012, citing Gurr 1977, van Dijk 1991 and Lagrange 2003). The crime drop, then, is primarily an empirical phenomenon. This trend of declining crime rates was first described in the USA (Tseloni et al. 2010), and since the mid-2000s researchers have also begun to analyse the crime drop in Europe (see Aebi and Linde 2012b) and internationally (for example Tseloni et al. 2010). This expansion of analysis into the crime drop from being US focused to being more international revealed important differences in the manifestation of the crime drop in different countries (Aebi and Linde 2010, Farrell et al. 2014).

In the USA, the crime drop has been described as a general phenomenon (Aebi and Linde 2010), being manifest across multiple types of crime (Tonry 2014). In Europe, Aebi and Linde (2012b:60) contend that "homicide and theft registered an overall decreasing trend; rape, assault, and drug offences increased constantly; while robbery increased in a curvilinear way until 2004 and is stable since then", with these trends being consistent between police recorded crime, victimization and convictions (Aebi and Linde 2010 and Aebi and Linde 2012b). Falls in some types of crimes, such as vehicle theft, are common across jurisdictions (Farrell et al. 2014). However, even within Europe there is variation in the manifestation of the crime drop, with England and Wales, for example, seeing falls in violence, vehicle theft and domestic burglary (Britton et al. 2012) based on estimates from the British Crime Survey. Consequently England and Wales are noted as being an outlier amongst European countries analysed by Aebi and Linde (2012b), although it should be noted that this assertion of a general fall in crime in England and Wales is based only on analysis of a small number of crime types. This variation in experiences of the crime drop across Europe raises the question of whether the crime drop in Scotland has been manifest in the same fashion as in other European jurisdictions. The results from previous analysis of the crime drop in Europe that compares Scotland to other countries, as well as those focusing purely on Scotland, can provide an indication of how similar observed trends in crime are between Scotland and elsewhere.

The analysis of convictions trends over the crime drop in Western Europe undertaken by Aebi and Linde (2012)[37] provide some indication of similarity between the manifestation of the crime drop in Scotland and elsewhere in Europe. In these analyses, Scotland is included as part of the Western Europe group[38], and compared against trends in Central and Eastern Europe (CEE)[39]. Based on this analysis they conclude that Western Europe and CEE show similar trends in convictions in the early 1990s and early 2000s, with increases in the number of people convicted across crime types in the 1990s followed by declines in property offences in the early 2000s but increases in convictions for drugs and violence. For the purposes of this analysis it is important to note that the aim of Aebi and Linde (2012) was not to *test* for similarities within these clusters, and they do not list any specific country within either Western European of Central and Eastern European cluster as showing trends distinct from the other countries within that cluster. However, when describing results across different crime types, they do demonstrate some differences between convictions trends in Scotland and other countries considered. For example, Aebi and Linde show increases in convictions for attempted homicide in Scotland, similar to Austria, Belgium, Italy, Netherlands, Sweden, Switzerland, England and Wales but not to the other countries they list in Western Europe. Scotland was one of eleven countries to show increases in convictions for assault, but only Scotland and Northern Ireland had lower conviction rates for robbery in 2006 than 1990. Overall these results suggest broad similarity between Scotland and other countries in Western Europe in their experiences of the crime drop, but with differences in trends for some crime types which suggest that Scotland should not be seen as a perfect proxy for all Western Europe.

Analyses of the crime drop which focus particularly on Scotland are also helpful to understand how similar the experience of the crime drop has been in Scotland in comparison to other countries. Humphreys et al. (2014) described trends for police recorded crime in Scotland and analysed the factors associated with trends in crimes of different types. They found that the aggregate trend of declining police recorded

37 Other analysis by Aebi and Linde (2010, 2012b) which relied on victimization data did not include Scotland (Aebi and Linde 2010, 2012b).

38 These countries are Austria, Belgium, England and Wales, Finland, France, Germany, Greece, Italy, Netherlands, Northern Ireland, Norway, Portugal, Scotland, Sweden and Switzerland.

39 Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Moldova, Poland, Romania, Russia, and Slovenia form Aebi and Linde's (2012) Eastern Europe group.

crime from 1991 represented contrasting trends across different crime types. This divergence across crime types is illustrated in Figure 3.1, which illustrates numbers of crimes recorded by the police of different crime types between 1971 and 2015-16. These trends can be considered in line with those described by Aebi and Linde (2012b) with falling theft offences (as measured by crimes of dishonesty) being the main driver of lower overall crime rates, and drugs offences (the primary driver of increases in Other crimes) increasing.

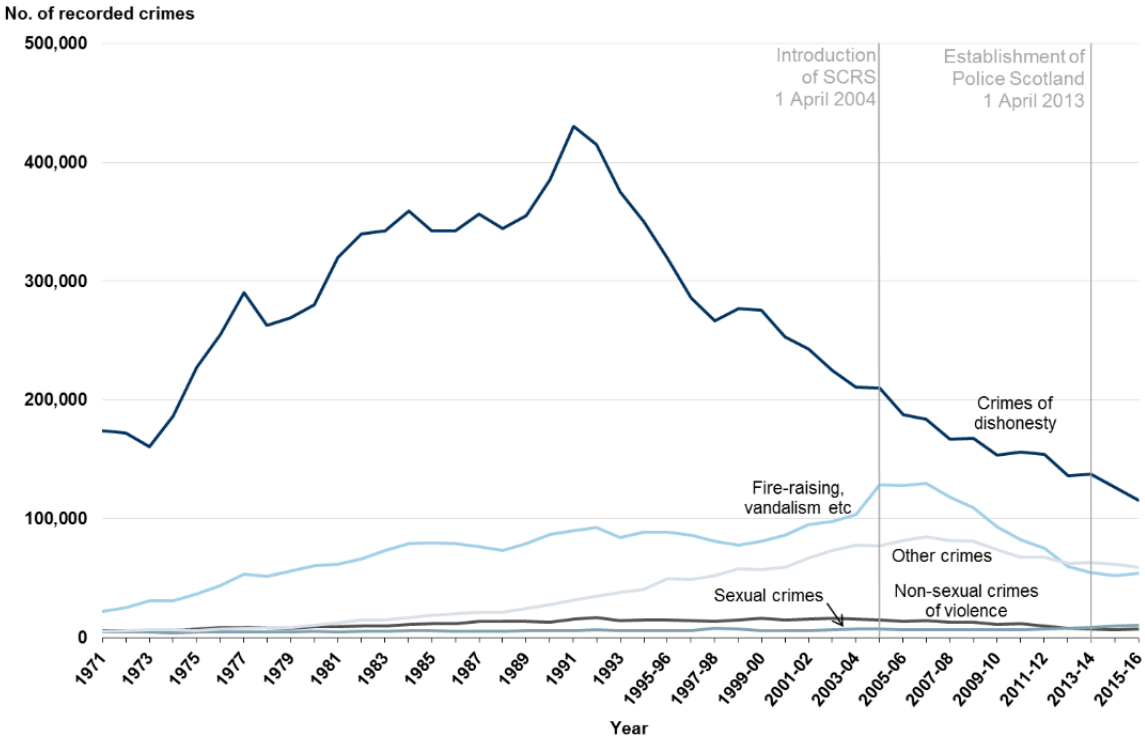

Figure 3.1. Trends in recorded crime in Scotland. Categories reflect Scottish Government's five-group crime classification. Adapted from Scottish Government (2016d:11)

In a complementary analysis to that of Humphreys et al. (2014), Norris et al. (2014) examined victimization trends in Scotland between 1993 and 2011. They demonstrated falling overall victimization rates which are primarily due to a reduction in the proportion of people who are infrequent victims of crime. Motor vehicle crime, such as theft of or from cars, and household crime such as vandalism and housebreaking showed notable declines. Again, the importance of lower crimes of theft, and particularly vehicle crime, are similar to findings in other jurisdictions.

Together, these results show broad similarity in the experience of the crime drop between Scotland and other countries in Europe, with falls in crime since the 1990s driven by crimes of dishonesty. Other crime types, such vandalism and drugs offences increased during this period. After 2006, however, there are reductions in the number of crimes recorded across different crime types in Scotland. This similarity between the manifestation of the crime drop in Scotland and other parts of Europe also indicates that the manifestation of the crime drop in Scotland differs from that in the USA; for example, whilst rates of violent crime fell in the USA during the 1990s, in Scotland they increased during this period.

Importantly, hypothesised explanations of the crime drop flow from descriptions of trend in crime rates such as those discussed above (Baumer 2010:4). Chapter Two demonstrated that criminal careers concepts can provide additional measures by which to describe change in patterns of crime over the course of the crime drop. The next section illustrates in more detail how research into the relationship between age and crime has influenced the study of the crime drop, and how descriptions of criminal careers can be used to refine theories of the crime drop.

3.3 Bridging criminal careers and explanations the crime drop

There have been two ways in which the findings of research into age and crime have influenced explanations of the crime drop. Most directly, the typical shape of the age-crime curve has been the basis of demographic explanations of changes in crime rates (Marvell and Moody 1991). These explanations suggest that changes in the age structure of populations, and in particular increases or decreases in the number of young people in societies, can explain changes in crime rates. In this way the relationship between age and crime serves as a hypothesised explanation for reductions in offending behaviour, with fewer young people leading to less offending (Zimring 2007). This potential explanation for the crime drop is discussed further below.

Second, concepts from criminal careers research can have been suggested as framework by which to *describe* crime trends. In this way the criminal careers literature helps to understand the potential *mechanisms* leading to lower crime

rates, rather than as an explanation for falling crime in itself. In the most wide-ranging discussion of the relationship between criminal careers and the crime drop, Farrell et al. (2015:5-7) suggest that the parameters of onset, desistance, prevalence and frequency (see also Berg et al. 2016), as well as the mix of different groups of offender within the population, can produce helpful descriptions of the crime drop which can be used to inform explanations of falling crime drop. Kim et al. (2015) make a related point, using change in the age-crime curve to understand the crime drop based on the assertion that change in the age distribution of crime (and therefore also falls in aggregate crime rates) can be conceptualized as comprising period effects or cohort effects. In the age-period-cohort (APC) framework, period effects affect everyone in a given year equally. In contrast, cohort effects affect those born in a particular year, regardless of their current age. Period effects may not be evenly distributed, affecting those of certain ages (age-period interactions) or from certain birth cohorts (cohort-period interactions). We should note, though, that age-period interactions are indistinguishable from trends in cohort effects (Cook and Laub, 2002:25, footnote 18), and so most simply the distinction of interest is between changes which are experienced equally across age in a given time point (period effects) or those which are only seen by some age groups (cohort effects, age-period interactions or cohort-period interactions). Kim et al. (2015) use this framework to classify different explanations that have been offered for the crime drop[40] (see also Cook and Laub 2002).

The value of using criminal careers concepts to understand the crime drop comes from the inductive nature of crime drop explanations. Most of the work in explaining the crime drop has taken the form of "describing data patterns and generating hypotheses from and about those patterns" (Baumer 2010:4). Consequently, if the descriptions upon which these theories are based omit important information, the theoretical accounts based on these descriptions may also be inaccurate. Without knowing how the crime drop is manifest across different criminal career parameters a "fundamental" element of this description is left unclear (Berg et al. 2016:2), and so describing change in criminal careers can provide a valuable set of data patterns which can be used describe changing crime trends. In turn, this can help to sharpen

40 Kim et al. consider explanations relating to changes in policing strategies and increased imprisonment rates as period effects, and relative cohort size, the legalization of abortion in the USA and the banning of leaded petrol as cohort effects.

hypotheses about the likely causes of falling crime (Berg et al. 2016:5). A more detailed description of how different parameters of criminal careers have changed over the crime drop can refine understandings of the mechanisms driving this change.

Importantly, descriptions of criminal careers are not used as either tests or confirmation of such theories. Instead the preference here is to see the exploration of convictions trends across criminal careers parameters as part of the descriptive work described by Baumer (2010:4) as necessary to *precede* theory testing[41] (Gerring 2012:733). This use of descriptive analysis differs from that of Farrell et al. (2015), who suggest that criminal careers concepts can provide 'data signatures', defined as "distinct patterns in data that would be expected if a given hypothesis were true" (2015:4, citing Eck and Madensen 2009), which can support particular crime drop explanations. With this understanding, if patterns of observed data fit with a particular theory of the crime drop this is taken as support for said theory. However, there are two potential problems with this confirmatory approach. The first is a logical problem; the fallacy of affirming the consequent[42]. Simply stated, it is preferable to use evidence to falsify or reject, rather than to support, hypotheses because there may be other, unknown, conditions which may have led to the observed in the data (Popper 1963). Patterns in data may fit with a number of hypothesised mechanisms, or indeed reflect a process different to all those proposed in the literature.

Second, theoretical explanations of the crime drop – and indeed, aetiological explanations of crime more generally (Paternoster and Triplett 1988) – may not be explicit about whether mechanisms are supposed to work through period or cohort effects, or prevalence or frequency (Berg et al. 2016), or indeed any particular parameters of criminal careers. For this analysis, framing particular explanations of the crime drop as implying particular patterns of criminal careers and then using descriptions of criminal careers as confirmation of these theories, whilst not

41 See also discussion in Chapter Four.

42 This fallacy can be stated as
1. If P, then Q.
2. Q.
3. Therefore P.
This reasoning is faulty, as P is not stipulated as the only condition which can lead to Q. (McCord 1986).

impossible, may require extending these theories beyond the original intention of their authors. As a result, descriptions of change in criminal careers in this thesis are interpreted as having implications for *developing* theories of the crime drop rather than testing them. However, whilst this thesis focuses only on four particular explanations of the crime drop (see Section 3.3 below), the results presented here can be used to refine *any* potential explanation of the crime drop in Scotland and potentially further afield (although see Section 3.6).

Having established the value of examining change in criminal careers to understanding the crime drop, this chapter now considers different theoretical explanations of the crime drop and how they align with the four criminal careers concepts as discussed in Chapter Two.

3.4 Explanations of the Crime Drop

Having demonstrated the value of the criminal careers approach for understanding theories of the crime drop, this section discusses four potential explanations for observed falls in crime rates; demographic change (Zimring 2007), the security hypothesis (Farrell et al. 2011, 2014), Aebi and Linde's multifactor explanation (2010, 2012) and cultural change (Tonry 2014, Young 2004). This section also discusses one potential confounding factor; change in justice system practices (Aebi and Linde 2010).

A large number of possible explanations for the crime drop have been proposed (see Farrell 2013), but not all such explanations are discussed here. The first four of the explanations discussed here – demographic change, the security hypothesis, multifactor explanation and cultural change – were chosen because they are cross-national (see Farrell et al. 2014:458) and so are better placed than country-specific factors to account for the international nature of the crime drop (Farrell 2013). Changing practices of the justice system are not considered as a potential explanation of the crime drop *per se*, but can play an important role in understanding trends that are observed in official statistics.

Demographic change

Demographic change was one of the first explanations proposed for declining crime rates (see Zimring 2007). This explanation states that if there were fewer people of the typical ages with high offending rates (that is, fewer young people) in a given society aggregate crime rates would naturally decline, as there would be fewer people in the typically high-crime ages. However, research into the effect of demographic change on crimes rates has shown limited capacity for changes in age-structure to explain the crime drop (Zimring 2007)[43]. Zimring concludes that "the modest influence of shifts in population can be overwhelmed by other social trends that influence crime rates" (2007:62), as changes in demographics are necessarily gradual, whilst changes in crime rates which can be much more sudden (Zimring 2007).

Levitt (1999) reaches a similar conclusion based on an analysis using the techniques of standardization and decomposition (Kitagawa 1964, Das Gupta 1993). Using this approach Levitt (1999) found that between 1960 to 1980, during which overall crime rates rose sharply, changes in age structure account for between 10 and 20% of the overall increase in crime. In contrast, from 1980 to 1995, when there was much less overall change in crime rates, demographic change can explain around 40% of the change in murder rates, 62% of the change in rates of property crime, and suppressing the increase in violent crime by almost 80%. The same techniques were applied by Rosevear (2010) to examine the effect of age structure on apprehension[44] rates in Western Australia and Southern Australia between 1987-1997 and 1998-2004. This analysis similarly found that a falling proportion of young people in the population[45] reduced arrest rates in both periods, but that this effect was on the whole much smaller[46] than the effect of change in apprehension rates *per se* (2010:197) – that is, the combined effect of prevalence and frequency. Using a different methodological approach to Rosevear and Levitt, Marvell and Moody (1991) provide a review of 90 studies which take a regression approach to analysing

43 One implication of this observation is that the relationship between age and crime is more ambiguous than that suggested by analysis which has focused on the age-crime curve (Marvell and Moody 1991:256)

44 An apprehension report is filed "when an alleged perpetrator is cautioned, arrested or reported" (Office of Crime Statistics and Research 2005:46).

45 Termed 'structural ageing' by Rosevear (2010).

46 Change in the apprehension rate typically had an effect on overall apprehension levels between four and seven times greater than change in age structure (author's own calculations based on figures provided in Rosevear 2010:192-193 and 196-197).

the impact of age structure on crime rates. Based on this review, Marvell and Moody and also conclude that demographic change is of limited capacity to explain crime trends (1991:256).

Whilst the work of Levitt and Zimring shows that age-structure can only be of limited use in itself to understand change in crime rates, it can provide a useful supplement to analysis of change across dimensions of criminal careers. As analysis of age-specific offending rates alone can obscure changes in population age structure (Blumstein et al. 1988a), demographic change must be accounted for when exploring change in criminal careers over the course of the crime drop. As illustrated by Levitt (1999), demography can also interact with other factors to reduce crime rates, making it a necessary component to consider alongside other explanations of falling crime rates. Moreover, the research reviewed above can be extended by examining the separate effects of age structure prevalence and frequency, which is obscured when the decomposition approach only considers age-structure and "all other sources" of variation together (Levitt 1999:582).

The security hypothesis

Drawing on routine activities theory, Farrell et al. (2011, 2014) proposed an explanation for the crime drop based around a greater prevalence and higher quality of security measures. Farrell et al. (2014:459) suggest that security measures can increase the perceived risk of offending, reduce the perceived rewards of offending, or increase the perceived effort of offending. This explanation is based on the primacy of crimes of dishonesty in declining crime rates, with reductions in the number of criminal targets available, particularly for car theft, burglary and shoplifting, leading to lower property crime rates (2014). Support for this explanation comes from analysis of methods of theft from cars and and burglaries in England and Wales and Australia (Farrell et al. 2014:462-270) which show sharp reductions in the proportion of crimes which involve overcoming poor security measures over the course of the crime drop.

In addition to these direct effects of better security measures in reducing offending, Farrell et al (2011, 2014) assert that car theft and burglary, the crimes they anticipate to be most affected by securitization, play a key role in the development of criminal

careers. This link between securitization and criminal careers comes via what Farrell et al. (2014) term keystone crimes and début[47] crimes. Starting with keystone crimes, Farrell et al. (2014) contend that reductions in crimes of dishonesty also reduce the rate of other types of crime which are often committed at the same time as crimes of dishonesty. This effect is therefore cross-sectional. Farrell et al. give the examples of violence committed alongside property crimes (2014:476), or fewer stolen cars reducing possible transport to commit burglaries (2014:474). Farrell and colleagues suggest the keystone crime hypothesis because most offenders are not 'specialized', with a focus on a particular crime type, and instead commit crimes of multiple crime types (2014, citing Farrington 1998 and Piquero et al. 2007). It is through this keystone crime hypothesis that the security hypothesis can explain both differing trajectories across crime types (2014:456) but also knock-on effects from falling crimes of dishonesty to other crime types (2014:474). However, this assertion is controversial, with Tonry flatly stating that this supposed link between reductions in crimes of dishonesty and falls in other types of crime is "not credible" (2014:52). There is therefore a question about the assertion of Farrell et al. (2014) that the fall in crimes of dishonesty has had a knock-on effect to other crime types.

Début crimes are those particularly important to the onset of a criminal career (Farrell et al. 2011) and likely lead to longer criminal careers. Farrell and colleagues contend that by removing such offences, fewer people begin criminal careers, thus reducing the volume of crimes committed (Farrell et al. 2015). Conversely, those who grew up in a time of plentiful opportunities to offend are more likely to begin criminal careers (Farrell et al. 2015). This hypothesis is based on analysis which shows falling youth convictions over the course of the crime drop (Farrell et al. 2014, 2015) and, drawing on Moffitt's (1993) dual taxonomy theory of offending, Farrell et al. (2015) suggest that falling prevalence of youth conviction over the course of the crime drop is most likely to represent a lower prevalence of adolescence-limited offenders[48]. As with the keystone crime hypothesis, Farrell et al. (2015) contend that

47 Also referred to as 'gateway' crimes (Farrell et al. 2014).

48 It should be noted though, that rather than being based on the assumed impacts of better security measures, this is founded on Moffitt's (1993) contention that increases in crime form the 1930s to the 1980s were due to an increase in the prevalence of convictions for adolescents. From Moffitt's (1993) original statement of the dual taxonomy theory it is not clear how exactly crime types match on to these two categories. Moffitt suggests that life-course persistent offenders are more likely to engage in"victim-oriented offences, such as violence and fraud" (1993:700) whilst adolescence-limited offenders will be involved with status-related crimes such as "vandalism, public order offences, substance abuse, "status" crimes such as running away, and theft" (1993:700). Moffitt

acquisitive crimes are most likely to be début crimes. This assertion draws on research which shows an association between a first conviction for theft offences and a higher number of total convictions (see Svensson 2002, Owen and Cooper 2013). However, both Svensson (2002) and Owen and Cooper (2013) both rely on convictions data to make the assertion that a first *conviction* for crimes of dishonesty lead to longer criminal careers. Farrell et al. (2015) then infer a relationship between acquisitive offending, particularly vehicle theft, and future criminal careers. This is problematic given the potential discrepancy between convictions and offending behaviour. In contrast, DeLisi (2015) analysed self-reported offending data to examine the relationship between type of first offence and subsequent self-reported offending, finding that drugs offences were the only type of crime related to the measure of chronic offending adopted. Again, there is a question about this hypothesised link between securitization and patterns of criminal careers.

These different elements of the security hypothesis – the securitization component, the keystone crimes component and the début crimes component – suggest different impacts on criminal careers. Logically, greater security measures would seem to suggest a period effect; presumably a car immobilizer is equally effective at preventing theft by a person of any age. The securitization component, then, suggests a period effect concentrated in crimes of dishonesty. Whilst Farrell et al. (2015:4) contended that security measures have greater effects for young people, they do not provide a potential mechanism to explain this effect[49]. As such the status of this claim must be considered uncertain. The keystone crimes component of the security hypothesis expands the reach of this period effect from falls in crimes of dishonesty to reductions across other types of crime such as violence and burglary.

In contrast to these period effect, the impact of début crimes suggests a cohort effect, working through reductions in the onset of offending, which should show reductions

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also suggests that during adolescence, however, these two types of offenders are indistinguishable based on their patterns of offending in terms of "variety of laws broken, frequency with which the were broken, and number of times they appeared in juvenile court" (1993:678). It is possible then that both adolescence-limited and life-course persistent offenders would be affected by securitization during adolescence if both display similar offending patterns during this time.

49 Farrell et al. (2015:4) stated that "Since adolescents with less experience and fewer resources for offending are more susceptible to crime blocking by improved security—as found by, for example, the studies of declining car theft where youthful joyriding declined disproportionately—there are grounds to infer a significant début crime inhibition effect induced by improved security measures." As this suggestion is stated without citation to a particular study it is difficult to verify.

in crime across all crime types. Indeed, it is this cohort effect which explains the *increases* in arrest rates for those in their forties who have "learned their trade" as offenders in the 1980s (Farrell et al. 2014:479). This mechanism seems to imply that falls in crime would be primarily due to prevalence (i.e. fewer people beginning criminal careers) rather than frequency. It is less clear how this cohort effect would interact with increases in security measures in recent years. Farrell et al. (2015) note that these 'experienced' cohorts have higher arrest rates than previous cohorts at the same age (i.e. a cohort effect). However, it is not discussed whether securitization has also decreased offending by these cohorts *relative* to their (counterfactual) offending rate if there had not been any effect of securitization, or whether these cohorts are somehow immune from from effects of securitization because they have already 'learned their trade'. The former condition would suggest both a cohort effect and a period effect, and the latter purely a cohort effect. In either scenario, it seems implausible that these effects can be reconciled with Farrell et al.'s earlier suggestion that securitization may have "truncate[d] the duration" of criminal careers (2011:168). As a part of this cohort effect, Farrell et al. (2015) suggest that the effects of securitization are most likely to be focused on adolescent-limited offenders. By implication, security measures may not have reduced offending by 'chronic' offenders, although Farrell et al. (2015) do not make this point explicitly.

Aebi and Linde's Multifactor Explanation

Aebi and Linde's (2010, 2012) multifactor explanation, like the security hypothesis, is based in routine activities and, in particular, change in the routine activities of young people. Aebi and Linde (2010) particularly focus on explaining the divergent trends for property crime and other crime types in Europe, suggesting that other scholars (including Farrell and colleagues) focus too much on the generality of falling crime rates in the USA. Consequently the multifactor explanation seeks to explain falls in crimes of dishonesty but *increases* in violence and drugs offences.

In essence, the multifactor explanation is based on different socio-economic groups facing different pressures on offending. Increases in drugs offences and violent offences are accounted for via gang membership in some parts of Europe, and a larger proportion of free time spent on the street for those without high-speed internet access, as well as increases in binge drinking for all groups (Aebi and Linde

2010:271). In contrast, for young people with unlimited internet access there is less time spent on the street and so fewer contact offences committed, but more computer offences. These factors combine with the better security measures that Farrell et al. (2014) describe to further reduce property crime (Aebi and Linde 2010:271). In this way the multifactor explanation incorporates elements of the security hypothesis, with the main difference between these two proposed explanations being the hypothesised relationship between dishonesty and other crime types. In the multifactor explanation, rather than working through falls in crimes of dishonesty, trends in other crime types have their own drivers which relate to broader social changes altering the distribution of opportunities to offend. This potentially suggests a greater degree of independence between crime types than that anticipated by the security hypothesis and the keystone crime hypothesis.

In contrast to Aebi and Linde (2010), Farrell et al. (2014) contend that wider internet access is not a viable explanation of the crime drop. Farrell et al. (2014) suggest that greater internet use cannot account for the crime drop during the early 1990s in America as the internet was not widely available until the mid-1990s, and even then only available as slow, dial-up connections. However, there may have been a "subsequent consolidation effect [of wider internet access reducing crime rates] significantly after the crime drop began" (Farrell et al. 2014:457). This raises an important question about the timing of different effects in Aebi and Linde's (2010) multifactor explanation. Whilst this is not discussed explicitly by Aebi and Linde (2010), Farrell et al.'s (2014) suggestion raises the possibility that different effects have had a greater prominence in reducing crime in different periods (see also Humphreys et al. 2014). A particular example of these differing effects relate to the factors Aebi and Linde (2010) describe as increasing violent crime: drug and alcohol consumption. In 2013 the prevalence of alcohol consumption and drug use by young people in Scotland was at its lowest level since the 1990s, based on the Scottish Schools Adolescent Lifestyle and Substance Use Survey (NHS National Services Scotland 2014). Whilst in their articulation of the multifactor explanation for the crime drop Aebi and Linde (2010) suggest *increasing* drug and alcohol consumption were leading to higher rates of violent crime, as drug and alcohol consumption have recently fallen in Scotland these factors may actually have produced falls in violent crime. By implication, the factors described by Aebi and Linde (2010) may have

different effects in different periods, potentially leading to both increases and declines in crime rates at different times.

It is also possible that factors identified by Aebi and Linde (2010) have differential effects for people of different ages. For example, Morgan (2014) suggested that cohorts particularly affected by the rapid rise of heroin use across the UK in the late 1980s and early 1990s may have played a role in increasing acquisitive crime rates during this period. Morgan (2014:155) stated that the waning of the heroin epidemic in the UK in the mid 1990s can potentially explain around 29% of the fall in acquisitive crime in England and Wales. Whilst changes in drug use are considered unlikely to explain the crime drop internationally due to the differences of timings in the rise and fall of drugs markets in different countries (Farrell 2013), Morgan's (2014) analysis is important in showing that drugs offences and associated crimes of dishonesty may be particularly likely to show differential trends over age because of strong cohort effects. Aebi and Linde (2010) focuses only on young people, but such cohort effects are important to consider when the focus is on understanding changing conviction patterns across the whole age distribution. These effects should, however, be understood as part of a wider set of factors involved in reducing crime rates (Morgan 2014:158).

The multifactor explanation as expressed by Aebi and Linde (2010, 2012) does not explicitly discuss whether the combined effect of these different forces driving crimes rates are likely to manifest as cohort or period effects. As this account explicitly focuses on changes in young people's behaviour, and does not not hypothesise any particular change for other age groups, it may be that the factors outlined by Aebi and Linde account only for falling youth crime. This leaves unanswered the question of whether the same factors have affected crime trends for older people. Looking at specific criminal career parameters, evidence relating to binge drinking and drug use cited by Aebi and Linde (2010:270-271) focuses on the prevalence of young people engaging in these activities. This would most plausibly also relate to the prevalence of offending. Internet access is suggested to relate to both the number of households with internet access but also time spent online (2010:268-269), suggesting possible effects on both prevalence and frequency. However, Aebi and Linde (2010) are not explicit in relating these factors to different

criminal career dimensions. Based on Aebi and Linde's (2010) exposition of the multifactor explanation there is little reason to anticipate that these influences would not increases rates of desistance and also affect both high and low rate offenders, and the "flexibility" of routine activities theories (Aebi and Linde 2010:265) mean that this explanation could be commensurate with change across different dimensions of criminal careers. As such it is not possible to infer particular effects of the multifactor explanation on specific criminal careers parameters based on Aebi and Linde's account.

Cultural change

A number of researchers have suggested different aspects of cultural change to be driving falling crime rates by. However, as theories of cultural change are difficult to effectively express quantitatively (Rosenfeld 2000, Wilson 2012) making them less informative for this analysis, and so less attention is paid to cultural explanations of the crime drop in this thesis. For example, Tonry's explanation of the crime drop as relating to "broad-based theories of social control and self-control" (2014:53) which have occurred across the Western world since the early twentieth century is intentionally sweeping, covering changing work patterns and adherence to moral norms contrary to offending and the diffusion of societal control mechanisms through society. As Tonry's explanation spans such broad topics and such a long time span, it is difficult to reconcile this explanation with changes in criminal careers with any degree of precision. The risk of such a wide explanatory scope as favoured by Tonry is that it overlooks important differences in the potential mechanisms in operation in different periods (Humphreys et al. 2014).

Others such as Young (2004) and Barker (2010) contend that falling crime rates are due to cultural change or, in Young's terms the "subcultural project" (Young 2004:34, citing Karmen 2000), of young people. These shifting social norms mean that offending may not be as attractive to young people – as "hip and cool" as Young puts it (2004:34) – now as in the past. This kind of cultural explanation is more straightforward to reconcile with change in criminal careers to the extant that it would presumably indicate either an age-specific period effect or cohort effect, with fewer young people in more recent years engaging in 'subcultural projects' (Young 2004) which involve offending. This type of change may also be more

straightforward to reconcile with prevalence rather than frequency; presumably if a person believes that it's not 'hip' to offend this will affect whether they offend or not, not how much they offend. It is also possible that cultural change may affect different types of crime differently. For example, Barker (2010) describes changing attitudes towards hard drug use, but not cannabis or alcohol, amongst young people. Outside of these potential differences in the consumption of different kinds of drugs, it is not clear how cultural change would affect trends across different crime types.

It is worth noting that the inferences made above about the potential impact of youth cultural change – its presence as either an age limited period effect or a cohort effect, and mostly likely to affect prevalence of offending – on are very similar to those made about the potential impact on criminal careers of the factors described in Aebi and Linde's multifactor explanation. From the results of this thesis it would not be possible to distinguish between these two explanations. Further theoretical work would be required to explore precisely which factors, for example, cultural change or change in routine activities caused by a higher prevalence of internet use, were of greater importance to reducing crime rates[50]. Developing such an explanation is beyond the scope of the current thesis, but it is important to note the potential interaction between cultural explanations of the crime drop and explanations based on routine activities theory as described above.

System Effects

The potential role of justice system effects in reducing crime has been suggested as leading to both reductions in offending behaviour and also potentially as leading to the observation of reductions in crime due to changes in punishment practices[51]. It is also possible that system changes can lead to *increases* in convictions, although this outcome has not received much attention in the discussion of the crime drop. However, it is always difficult to try to distinguish between system effects on convictions trends and policy effects on convictions trends. This section first discusses the hypothesised mechanisms for change justice system practices to

50 It is also possible that these explanations are not mutually exclusive. Little work has been undertaken on digital media and its impact on youth culture (for example Turkle 2011) and the crime drop. This may be a fruitful area for future research.

51 A further possibility is that the crime drop may be explained by changes in recording practices. However this is unlikely given the harmony in both declining recorded crime and victimization rates, as well as a small decline in recording rates for assaults (Aebi and Linde 2010:264-265).

reduce offending. Second, drawing on Cohen's (1985:44-45) description of potential changes in "deviancy control", this section describes potential system effects in reducing or increasing conviction rates. Finally, this section discusses how best to infer whether observed changes in convictions are due to system or behavioural effects.

System effects reducing offending: policing and imprisonment

Change in justice system practices, such as higher police staffing rates, changes in police practices and increased use of imprisonment have been suggested as a potential explanation for the crime drop (for example Levitt 2004). However, such explanations based have been widely dismissed (Farrell et al. 2014, Tonry 2014) as unlikely to be leading to falling conviction rates in multiple countries, as such explanations are typically jurisdiction-specific. As such, they fall foul of the cross-national test (Farrell 2013) considered necessary to explain the international nature of the crime drop. Explanations linking policing numbers to the crime drop also assumes police staffing has a direct effect on reducing crime, the evidence for which is at best mixed (Bradford 2011).

The potential effects of policing and imprisonment on reducing convictions rates can also be explored by analysing changes in prevalence and frequency (Berg et al. 2016). In particular, the potential effects of policing or imprisonment in reducing crime rates are more likely to work through the frequency of offending rather than prevalence (Blumstein et al. 1986, MacLeod et al. 2012:5)[52]. Following this logic, Berg et al. (2016:6, citing Paternoster and Triplett 1988) suggest that "proactive policing" strategies and incarceration effects would primarily operate through changes in frequency rather than prevalence, as such strategies focus on active offenders or high-risk populations. However, the assertion that policing and imprisonment effects would manifest in changes in frequency rather than prevalence can only be made tentatively here, as such a contention does not account for other factors that may also have influenced prevalence and frequency. Moreover, given that policing and imprisonment make poor candidates for explanations of the international crime drop (Farrell 2013) this thesis does not discuss their impacts at

52 MacLeod et al. (2012:5) state that increases in prevalence would require "primary prevention" targeted at the general population, whilst increases in frequency would require "tertiary" prevention aimed at only high-rate offenders.

length.

Punishment practices: different nets, wider nets, denser nets

As well as the justice system affecting the crime drop via strategies to reduce offending it is possible that the way in which cases are processed by the justice system may affected convictions trends (Aebi and Linde 2012). The work of Cohen (1985:44-45) suggests three possible ways in which such processing effects could be manifest. Changes in the operation of the justice system could lead to: new agencies or systems supplementing existing control mechanisms ("different nets"/diversion) leading to fewer convictions in courts; increases in the number of people who move into the system in the first place (due to "wider nets"); an increase in the "intensity of intervention" ("denser nets" [1985:44] or "thinning the mesh" [Cohen 1979:347]) leading to people circulating through the justice system at a higher rate. Each of these three effects is relevant to this investigation.

Diversion or "different nets". The implementation of diversionary policies is a way in which changes in justice system practices could lead to fewer convictions being registered in SOI. Diversion could therefore provide an appearance of a crime drop in convictions data (Soothill et al. 2008). A diversionary process would be expected to keep low-rate offenders out of courts (Soothill et al. 2008), instead punishing them in a different part of the justice system; the use of "different nets" in Cohen's terms.

This mechanism has two potential impacts for this thesis. First, diversion may then lead to the appearance of *increasing* frequency of conviction or longer criminal careers as those who remain in the justice system are only more serious offenders (Francis et al. 2007), affecting trends in frequency and polarisation. For example, Soothill et al. (2008:91) conclude that there has been a shift to "smaller numbers of convicted offenders but with more (and more varied) convictions" in England and Wales between the early 1970s and late 1990s. Soothill et al. (2008) conclude that the fall in specialist clusters identified in their model "may simply be the effect of system changes which have removed one-time offenders from the court arena" (2008:92) rather than behavioural changes which have reduced the number of

people only committing one offence[53]. Second, the effects of diversionary policies may be particularly pronounced for young people, who can be particular targets for diversionary policies (Soothill et al. 2004:412). Consequently there may therefore be an age component to diversionary policies.

Net-widening. Net-widening describes a situation in which offences which had previously not been prosecuted are punished within the justice system (Cohen 1985:44). As net-widening relates to the *numbers* of people coming into the justice system[54], it would be expected to influence the prevalence of conviction rather than frequency. Put another way, if there are observed increases in prevalence in SOI this may reflect net-widening rather than increases in offending. All things being equal, increasing the number of low-rate offenders would logically lead to lower polarisation as the number of low-rate offenders increases but the number higher-rate offenders are unaffected. By the same logic, net-widening may also reduce the frequency of offending, as a greater number of low-level offenders are brought into the justice system.

Cohen (1985:53) suggests that net-widening particularly relates to those with "fewer previous arrests, minor or no offences, good employment record, better education, younger, female". Net-widening practices therefore may have a greater effect for women than men. Estrada et al. (2015) suggest that increases in convictions for violent offences for women are a product of net-widening, rather than offending, and Steffensmeier et al. (2005) make a similar contention in relation to arrests. Net-widening effects may affect women more than men because minor offences, which are those amenable to net-widening, comprise a greater proportion of offending by women as opposed to men (Estrada 2015:5, citing Cohen 1985). This stresses the importance of examining trends in prevalence for men and women separately and also for exploring trends across multiple crime types,

Thinning the mesh/recycling. As 'thinning the mesh' relates to the "intensity" of punishment (Cohen 1985:44) such a process would be expected to increase the

53 As the change they describe primarily comes comparing cohorts between 1953 and 1963 (see Tables 4 and 5 in Soothill et al. 2008:87-88) substantively this conclusion is not especially relevant here.

54 In Cohen's words, "an increase in the total number of deviants getting into the system in the first place and many of [whom] are new deviants who would not have been processed previously" (1985:44).

frequency of conviction but not prevalence. The work of McAra and McVie (2007, 2010) describes a similar scenario in which the operation of the justice system affects the *rate* of convictions; what they term "recycling". McAra and McVie (2010:200) show that "certain groups" of young people are brought into the system "again and again" creating a "permanent suspect population", due to the labelling processes which are associated with continued contact with the justice system and other official agencies such as welfare systems. The process of recycling would also be expected to manifest in longer criminal careers (McAra and McVie 2010a). Whilst the focus of McAra and McVie's (2010a) analysis is on individual criminal careers, and so making inferences about overall convictions trends based on this analysis must be done carefully, it may be that a process of 'thinning the net' or recycling would, *ceteris paribus,* lead to greater polarisation of offending. Increased polarisation would be brought about by recycling increasing the number of people who meet the threshold of being a high-rate offender. Whilst McAra and McVie's (2010a) focus is on youth offending it is possible that this process of recycling may also apply to older adults.

To be able to understand the effect of these three principles in the current thesis requires an understanding of how Scottish justice policy has developed over the period of study. This is the topic of Section 3.5. However, before considering the particularities of Scottish justice policy, it is necessary to understand how system effects can be distinguished from behavioural effects in convictions data.

Identifying system effects in SOI

Distinguishing between system effects and behavioural effects is always difficult when working with convictions data (Aebi and Linde 2012). As such it is difficult to definitively identify whether observed trends are a result of behavioural or system changes. However, existing research suggests that three conditions suggest a potential system effect. First, there must be a plausible policy mechanism identified by an analysis of policy in the particular jurisdiction (Soothill et al. 2004, Aebi and Linde 2012). Identifying a potential mechanism requires an assessment of the type of crime affected by the potential system effect. For example, von Hofer (2000) suggests that the similarities in the timings of change in convictions rates across a number of types of crime may suggest system rather than behavioural effects if they

also coincide with known policy changes. He illustrates this approach by describing change in convictions for a number of types of violence in Sweden in the 1980s which occurred at the same time as changes in reporting routines and a greater awareness of youth violence in Swedish society (von Hofer 2000:64-65, citing Estrada 1999). Therefore, von Hofer concludes, increases in reported youth violence during this period likely represent an effect of change in reporting practice. This example also highlights the second condition; that the timings of the hypothesised mechanism and the observed change in conviction trends must align. Finally, Soothill et al. (2004:415) suggest that, whilst not mutually exclusive, period effects observed in convictions data typically imply a system mechanism. On the other hand, if the causal mechanisms behind change in convictions patterns are behavioural this is likely to manifest in a cohort effect[55].

Summary: Explanations of the Crime Drop and Criminal Careers

This review has served to show that different accounts of the crime drop have important implications for patterns of criminal careers. Different explanations for the crime drop suggest potentially important differences across types of crime, over age, between men and women and as manifest in cohort or period effects. However, very few of these theories (with the exception of the security hypothesis) make explicit reference to different parameters of criminal careers. As Berg et al. (2016) suggest, there is a lot of ambiguity in the proposed relationship between different aspects of criminal careers and theories of the crime drop. This means that inferences regarding different explanations for the crime drop based on patterns of criminal careers must be made tentatively. On the other hand, this lack of consideration from criminal careers concepts also means that the examination of criminal careers over the course of the crime drop provides an opportunity to help refine theoretical accounts of why crime has declined. Providing a descriptive account of how criminal careers have changed over period of the crime drop provides a step towards more precise explanations of this fall in crime, acting as a necessary precursor to the development of any causal propositions (Gerring 2010:733) regarding the crime drop.

55 Soothill et al. (2004:415) state "A behavioural change suggests a cohort effect… In contrast, a system change relates to period effects".

As discussed in this review, policy changes can affect trends in observed in convictions data. This raises an important avenue which must be considered in this thesis; how has policy changed in Scotland over the course of the crime drop, and could this change affect patterns of criminal careers? It is to the subject that this chapter now turns.

3.5 The Scottish Context

Understanding the Scottish context is key to proper interpretation of the analysis conducted in this thesis. First, as discussed above, analysis of changes in justice policy can help to understand if there are potential system effects which may have affected convictions patterns through net-widening, thinning the mesh or diversion. This section reviews literature analysing changes in justice policy in Scotland between 1989 and 2011 to assess whether there are potential mechanisms that may have influenced convictions patterns. This is accompanied by analysis of Scottish Government figures showing trends in the use of different disposals to see whether policy changes are reflected in diversion to non-court sanctions. Following this analysis of the Scottish context, this section considers to what extent Scotland can be considered a representative case of the crime drop. This consideration is based on assessment of the distinctiveness of Scottish justice and institutional set-up, and of previous comparative analyses of the crime drop in Europe.

Justice Policy in Scotland: Three Eras

Due to the time span covered by the SOI (see Chapter Four) the period focused upon here is that between 1989 and 2011. This period covers quite a turbulent period in Scottish justice policy. This period has been described as comprising three main eras, described as “welfarist”, “the punitive turn” and “compassionate justice” (McAra 2016). Important changes to the justice system in Scotland occurred around both 1999 and 2007 that may usefully inform our understanding of observed patterns in Scottish convictions data. These three periods reflect shifts in the underpinning philosophical approach to justice, leading to different policy programmes which in turn may have led to different impacts on bringing more people – especially young people - into the justice system or diverting people away from the justice system.

The focus of this discussion is on comparison between policy eras, rather than the effect of these eras *per se*; for example, whether one era was relatively more likely to divert people away from the justice system than the previous era, rather than change in absolute terms. Moreover, the account of policy change in Scotland provided here is necessarily brief and a simplification of a wide and heterogeneous policy area where changes are often complex (see Croall 2006, McAra and McVie 2010a), and where different observers have disagreed over the scale and meaning of policy change (Mooney et al. 2014). As a result it would be a mistake to overstate the discreteness of these eras. Given that these eras are defined in the literature relative to broad changes in justice policy, tracing cause and effect from particular pieces of legislation to observed changes in convictions patterns is fraught with difficulty. Nevertheless, political developments that occurred around the period of Scottish devolution in 1999 and the election of the SNP administration in 2007 have been noted as important turning points in the history of Scottish justice policy spanning the period of the SOI and so must be considered in this analysis.

The "Welfarist" era

The first policy period of interest here began with the establishment of the Social Work (Scotland) Act 1968, and continued through 1989[56] until the devolution of justice policy to the new Scottish Parliament in 1999. Broadly speaking, during this time Scottish justice policy was influenced by a social welfarist ethos (Croall 2006, McAra 2006). The Scottish justice system was marked by a distinctively civic culture which ensured that a distinctive style of welfare-based justice predominated compared to the more punitive set of rationales in England and Wales (McAra and McVie 2010b). The Social Work Act reinforced the value of rehabilitation which came to frame both adult and youth justice in Scotland through the increased use of social work services to deal with offenders. For adult offenders, the Act ensured that probation services were to be located in generic social work departments (McIvor and Williams 1999). The shift towards welfarism was especially evident in the realm of youth justice, however. The Kilbrandon Committee, set up in the early 1960s to review youth justice policy, had recommended that youth courts in Scotland be abolished and that a new tribunal system of juvenile justice be instituted. This new

56 McAra (2006) argues that this period began with the Social Work (Scotland) Act 1968 and was mostly consistent until the mid-1990s.

system was to be welfare-based and to focus on the needs of people who offend rather than focusing on their offending behaviour. As a result, the Children's Hearing System (CHS) was established by the 1968 Act and began in 1971. The CHS fully embraced the Kilbrandon principles and ensured that the best interests of the child were the paramount concern in decision making (McAra 2010:131),

The 1990s was a period in which was penal populism – an increased focus on punishment in the criminal justice system – was increasing in many countries, but these values did not filter through to the Scottish system (McAra 1999). In part this is explained by the particular institutional arrangements in Scotland (Morrison 2012), with strong local policy networks insulating Scottish justice policy from these pressures and maintaining the welfarist ethos of justice policy (McAra 1999). Despite this consistency, there were important legislative changes during this period. For example, 1991 saw the introduction of a new set of National Social Work Standards which aimed to reduce the use of imprisonment in favour of community sentences, with the overall aim of reducing reoffending rates. Following the implementation of these standards, the use of probation orders increased but remained a small proportion of total disposals (3.4% of all disposals in 1995, up from 1.6% in 1985 [McIvor and Williams 1999:203, citing Scottish Office 1997]). Consequently, whilst the introduction of these standards was an important policy change, the relatively small numbers of people receiving community sentences means that this change is unlikely to have had a significant impact on overall convictions trends in the SOI if the focus of the analysis is on all people convicted. Moreover, as this policy change occurred in 1991, there is little baseline in the SOI with which to identify any effects of this policy, as the dataset covers the period from 1989. In youth justice, the Children (Scotland) Act 1995 has been identified as an important shift in emphasis for the CHS. However McAra (1999) suggests that welfarism was still the dominant theme in Scottish youth justice in this policy era even after the 1995 Act.

So, it is potentially possible that the commitment to welfarism during this period may have played a part in the reduction of convictions, especially for young people. However, any effects of this commitment are likely to have occurred much earlier than 1989. Changes in disposals suggest that the introduction of the National

Standards for Social Work are likely to have had a minimal effect on total conviction patterns in this analysis. Otherwise, the first policy period covered by the SOI represents a period of relative stability in terms of policy change, so there is no obvious transformation that may explain a major drop in convictions at this time.

"The punitive turn"

The transition from the welfarist era to the punitive turn following devolution is due to not a particular policy as such, but rather an assessment of the cumulative effects of a number of policy changes and political rhetoric which led to a perceived change in the ethos of justice policy in Scotland. This period is considered punitive because the welfare and needs of individual offenders – given primacy under the Kilbrandon ethos – were downplayed in favour of a focus on harsh punishment and holding offenders responsible for their actions. The first signs of this punitive turn occur before devolution with the 1997 Crime and Punishment (Scotland) Act (McAra 1999), but devolution led to a turning point as it altered the institutional factors which had previously insulated Scotland from punitive sentiment (Croall 2006, McAra 2006). After devolution "virtually every aspect of criminal justice" came under a process of consultation, review and legislation (Croall 2006:587), and there was an "unprecedented" amount of legislative and policy change (McIvor and McNeill 2007:131). The effect of these changes was a shift in ethos away from welfarism towards penal populism, wherein concerns of 'experts' were rejected in favour of calls to public opinion and fears of antisocial behaviour (Croall 2005). Ironically, despite criminal justice being devolved to the new Scottish Executive, justice policy in Scotland became *more* like that in England and Wales (McAra 2006) where the New Labour government was keen to be seen as 'tough on crime, tough on the causes of crime' (Croall 2005). Political rhetoric too became increasingly punitive in Scotland, with then First Minister Jack McConnell famously criticising 'ned culture' and 'antisocial behaviour' during the 2003 election campaign (Croall 2005).

A helpful illustration of this punitive turn comes from Scottish youth justice where there was an increasing emphasis on punitiveness. In 2000, an advisory group on youth justice published a report 'It's a Criminal Waste'. The Scottish Executive responded by produced an Action Plan to Reduce Youth Crime, which set out a list

of priorities to reduce youth offending, including more programmes to target persistent offenders. A series of initiatives were introduced, including fast-track hearings to deal more quickly and efficiently with those who were perceived to be persistent offenders, and youth courts which had been abolished in 1968 (Croall 2006:593). This reflected a marked a shift away from the focus of the CHS on the welfare needs of young people rather than punishment. McAra (2010:131) has described this period as demonstrating a "full blown moral panic" about persistent youth offending.

Outside of youth justice, the Crime and Disorder Act (1998) was part of this punitive trend, extending sentences for sexual and violent offenders and introducing anti-social behaviour orders for those aged 16 and over (McAra 2008:492). There was an increased emphasis on community safety in the Safer Communities in the Scotland (1999) policy document and the Tough Option report (2002) emphasised that the focus of probation work should be on public safety, rather than the needs of the offender, a similar attitude expressed to that in the 2001 National priorities for criminal justice social work (Croall 2005:185-186). This recasting of probation as community punishment is typical of a more punitive ethos (McAra 1999, citing Garland 1996). In addition, the 2004 Anti-social Behaviour (Scotland) Act ensured that lower level behaviours were targeted through a series of civil orders which, if breached, were dealt with through the criminal courts (McAra 2008). The combination of the youth justice and antisocial behaviour agendas typifies this period post-devolution as demonstrating greater penal populism than during the Kilbrandon era (McAra 2016:5).

In response to this policy shift concerns were raised about potential net-widening effects (Piacentini and Walters 2006; see also McAra and McVie 2010a), with an increasingly harsh response to youth crime and low-level anti-social behaviour, and with the introduction of criminal sanctions to deal with breaches of civil orders, potentially bringing more people into contact with the justice system. Based on the mapping of Cohen's system changes on to criminal careers parameters (see Section 3.4 above), these potential net-widening effects may have led to increases in prevalence relative to the period between 1989 and 1999[57]. The intense focus on

57 That these effects are assumed to be present relative to convictions trends in the previous welfarist policy era means that it should not be assumed that similar *increases* in net-widening would be

youth people during this period would suggest that the effect on convictions should be greater for this group. There seems little reason to believe that these factors would have particular effects on different types of crimes; if it is contact with the institutions of the courts itself which leads to further contact with the court, it presumably does not matter for which type of crime the person was charged[58].

The era of "Compassionate justice"

The punitive turn ended when it became apparent to policy makers and politicians that the policies introduced by the Scottish Executive had not led to the intended reductions in persistent youth offending. Whilst the Scottish Executive responded by producing a new policy directive titled Getting It Right for Every Child in 2005, it was the election of a new minority Scottish National Party (SNP) administration in 2007 which took Scotland forward into a third phase of justice policy which McAra and McVie (2015: 270) termed 'the era of compassionate justice'.

The election of the new Scottish Government led to rapid changes in Scottish justice policy and legislation, with an increased emphasis on diversion from the criminal justice system and an ethos of minimum intervention by the justice system (McAra 2016:7). For example, the SNP administration introduced a number of new summary justice measures as part of the Criminal Proceedings etc. (Reform) (Scotland) Act 2007 which encouraged the use of pre-court disposals, such as police warnings and fines, rather than bringing cases to court. In response to persistently high imprisonment rates (despite a massive fall in recorded crime), the Scotland's Choice report (2008) advocated a reduction in the use of short term prison sentences, which was incorporated in the Criminal Justice and Licensing (Scotland) Act 2010. In youth justice policy, the Getting It Right for Every Child policy was expanded and underpinned the development of a new Whole System Approach to young people involved in offending, which was piloted in 2009 and rolled out nationally in 2011. The net effect of this change in youth justice policy was to reduce the number of young people referred to the CHS on offence grounds and in doing so

observed in England and Wales, despite the convergence of policy programmes between the two jurisdictions.

58 Whilst net-widening may particularly affect minor offences (Estrada et al. 2015), this particularly relates to the seriousness of the crime rather than the particular type of crime, and so it is questionable that any net-widening effects would be reflected in increased prevalence for a particular crime type.

keep young people out of the court and prison systems (McAra and McVie, forthcoming). The emphasis of justice policy during this period was to apply diversionary measures to keep offenders out of court as far as possible, and to prioritise community-based disposals over imprisonment (McAra 2016:7).

Again, this policy era represents a number of legislative changes across a number of domains, and so tracing cause and effect from particular policies to observed changes in convictions rates must be done with great care. That said, the era of 'compassionate justice' provides a potential explanatory mechanism by which diversionary policies may have resulted in fewer people being convicted in court. This raises the possibility that changes in convictions after this period may relate to the displacement of cases away from courts and into summary disposals or away from the justice system entirely. This may have led to fewer convictions being observed in the SOI without any reduction in actual offending rates, potentially manifest in a decline in the prevalence of conviction in the SOI.

Operationalizing policy eras

The above review has emphasised that care must be taken when inferring potential effects of these broad policy and rhetorical changes on conviction rates. Given that the idea of a 'punitive turn' relates to both policy changes and wider political rhetoric and attitudes, tying cause and effect to particular pieces of legislation may imply too simple a mechanism of policy change affecting convictions rates. Moreover, interpreting changes in justice policy and understanding their potential impact on convictions patterns is further complicated by the gap between policy and implementation (McNeill et al. 2009). A helpful guide for how to operationalise these changes is provided by McAra (2016). McAra compared the results of regression models predicting being brought to a CHS offence hearing or to court for a cohort at different ages (11, 15 and 22) which correspond to these three policy eras. McAra then compared the model coefficients to determine whether the institutional processes at work vary across policy eras, finding qualitatively similar results between eras. In the same fashion, the current analysis can help to investigate if these policy eras had particular effects on observed convictions trends by making qualitative comparisons between trends observed in different eras using the framework outlined in Section 3.4 to assess whether trends are most likely to be

policy shifts of behavioural shifts.

McAra's finding of little difference in institutional practice between policy eras does not detract from their value in this analysis. McAra's (2016) analysis does not seek to compare the relative size of the effects of system contact on being called to court or an offence hearing between policy periods. As a result, there may be "continuities in institutional practices" (2016:12) but of varying magnitudes in different policy eras[59], which may still lead to potential differences across eras in aggregate conviction patterns. Moreover, because McAra (2016) focuses on a single cohort who are only old enough to have cases heard in court in one of the three periods (the compassionate era), her analysis is limited in its capacity to compare the effect of different policy eras on court convictions for different cohorts, which is the focus of this study. Therefore, McAra's (2016) use of these three eras to inform her analysis of changing institutional practices illustrates the value of seeing these three periods as potentially distinct when analysing changes in patterns of convictions over time. This is particularly true given the descriptive nature of the research design adopted (see Chapter Four).

Trends in non-court disposals

A possible impact of the increased emphasis on the use of non-court disposals after 2007 is that cases which were disposed of in courts in previous policy periods may instead be dealt with elsewhere in the justice system, either by police directly or by Crown Office of Procurator Fiscals (COPFS)[60]. As described above, this would be an example of the use of 'different nets', and may mean that any falls in convictions as observed in SOI may merely reflect increases in disposals elsewhere in the justice system. It is also possible that diversionary policies may particularly affect young people (Francis et al. 2007). These two possibilities are discussed below.

Aggregate trends

To assess the impact of this summary justice reform, Figures 3.2 and 3.3 present

59 The magnitude of effect of previous CHS offence/court referrals was much smaller during the punitive turn (odds ratio of 2.8) than in the compassionate era (13.8). However, because McAra focuses on a single cohort the comparison of the size of these effects may be skewed because of the different set of institutions involved at age 22 (courts) than at age 15 (CHS).

60 Procurator Fiscals decide whether a case should be tried in court, no action taken, or a fine levied without the case going to court (see Audit Scotland 2011).

trends in the use of non-court disposals. These trends are presented in conjunction with trends in police recorded crime, convictions in courts and the number of cases deemed not to require any action by COPFS. If increases in the use of non-court disposals are accompanied by declines in the convictions and convictions make up a smaller proportion of recorded crimes, it suggests displacement of cases from courts to other disposals[61]. To examine change over time in the use of these disposals, Figure 3.1 shows an index of COPFS disposals, COPFS cases with no actions taken recorded crime and prevalence of conviction. Figure 3.2 shows trends in COPFS disposals, no actions taken, and prevalence of conviction as a percentage of the comparable number of crimes recorded by the police. Together these figures can provide an indication of whether there are substantial differences in trends between recorded crime and convictions that could be attributable to changes in the use of non-court disposals.

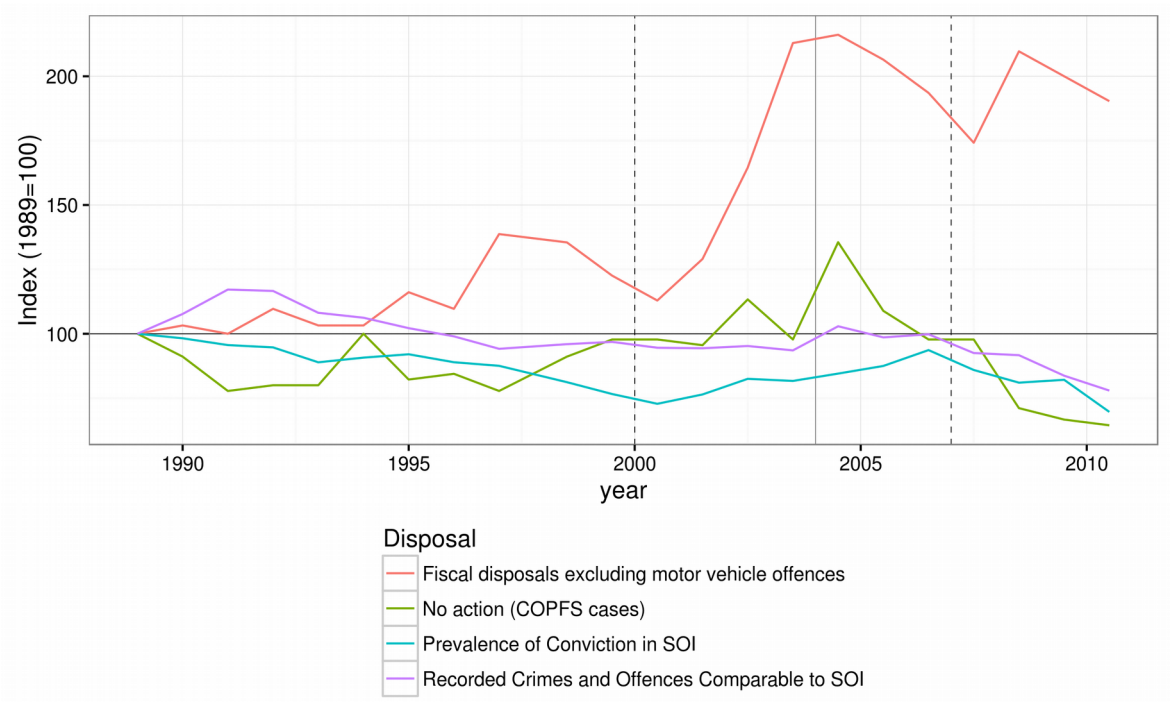

Figure 3.2 Comparison of trends in non-court disposals, convictions and recorded crime. Dashed lines mark change between policy 'eras' as outlined by McAra (2016). Solid line marks introduction of new police recorded crime standard in 2004.

Figure 3.2 shows that trends in the prevalence of conviction (blue line) and in

61 Returning to Cohen's (1985) metaphor; this change in the institution dispensing punishment would entail the use of different nets.

recorded crime (purple line) are broadly similar. Both decline through the early 1990s and then again from 2007. There is a difference in that police recorded crime remains at a consistent level between 1997 and 2007, whilst convictions continue to fall until 2000, and then increase to 2007. This similarity in trend suggests that there does not appear to be substantial bias over time in the relationship between SOI convictions and recorded crime. This suggests that there have not been extreme changes in the way cases process through the justice system that have affected the number of convictions listed in SOI. In contrast, Figure 3.2 shows a substantial increase in the number of disposals issued by the COPFS between 1989 and 2011, as shown by the red line. However, the use of COPFS disposals increases particularly from 2000 to 2004, a period when convictions also increase, albeit by a much smaller amount. Moreover, levels of recorded crime show little change from 2000 to 2004. During this period, then, the increased use of COPFS disposals are not accompanied by reductions conviction rates, nor do they reflect increases in recorded crime.

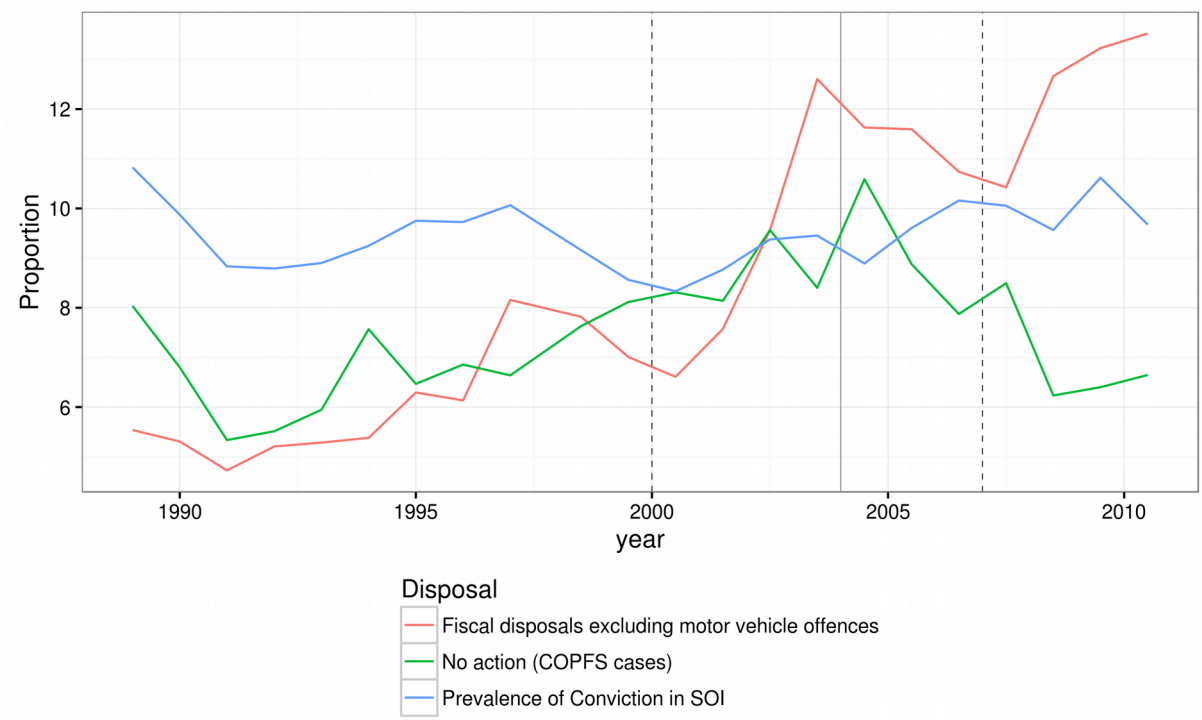

Figure 3.3 Non-court disposals and convictions as a proportion of recorded crime. Dashed lines mark change between policy 'eras' as outlined by McAra (2016). Solid line marks introduction of new police recorded crime standard in 2004.

This conclusion is reinforced by Figure 3.3 which shows that even while COPFS disposals increase substantially as a proportion of recorded crime, convictions also show an increase as a proportion of police recorded crime. This trend of convictions increasing as a proportion of recorded crime is unlikely to be explained by clear-up rates; whilst police clear-up rates in Scotland increased throughout the 1990s, from less than 30% in 1990 to over 40% in 2000, the change in clear-up rate between 2000 and 2004/5 is around three percentage points (Scottish Executive 2005). Overall then, and based on the analysis of policy change above, this increase in COPFS disposals may be due to a net-widening effect of justice policy between 2000 and 2007, with more people coming into the justice system at the lower level of COPFS, but these cases not making it through to courts.

Diversion and the age-distribution of conviction

It is possible that diversionary effects may particularly skew the age distribution of conviction if they are particularly concentrated on young people (Francis et al. 2007). Matthews (2016) examined whether recorded crime, victimization and COPFS disposals showed different trends for men and women of different age groups between 2008/09 and 2013/14.This analysis found that for young people there were similar trends between 2008/09 and 2011/12 in both data sources, with falls in convictions accompanied by fewer non-court disposals during this period. This suggests that conviction trends for young people in Scotland were not disproportionately affected by uses of non-court disposals. However, for those over the age of 21, and particularly those over the age of 30, fewer convictions were accompanied by a higher number of non-court disposals. This suggests that there may be some displacement of convictions for those over the age of 21 into non-court disposals rather than into courts, although this effect may only relate to the last few years of data in SOI. On the whole, as recorded crime and victimization also decline during this period (see discussion in Section 3.2) it is likely that lower conviction rates and lower use of non-court disposals both reflect lower crime rates. This observation in conjunction with Figures 3.2 and 3.3 suggest that changes in the use of non-court disposals seem unlikely to have led to declines in convictions in SOI due to cases increasingly being dealt with elsewhere in the justice system.

3.6 Distinctiveness and generalization: Scotland as a case study of the crime drop

There is a final question which must be addressed while considering the features of Scotland as a case study of the crime drop: how similar is the Scottish case to other jurisdictions? This question brings together a number of themes running through this chapter. First, from the existing literature on the crime drop described in Sections 3.2 and 3.3, the most appropriate starting assumption when generalizing findings from studies of the crime drop should be that analysis from a single jurisdiction should be treated with caution (Farrell 2013). Focusing on the particularities of a single case may therefore lead to inaccurate inferences, and given the empirical uncertainty regarding how patterns of criminal careers have changed over the crime drop – indeed, this is part of the motivation for this thesis – the default position should be one of caution regarding generalizing trends observed in Scotland to other countries.

Moreover, the question of Scottish distinctiveness in institutional and policy arrangements has seen considerable attention, often in the same analyses described above which trace developments in Scottish justice policy (for example, McAra 2006, Mooney et al. 2014). For example, in the context of youth justice, McAra (2010) describes Scotland as representing an "exemplar" of the lay tribunal model of justice, in contrast to those seen in England, Belgium, Finland and New Zealand. Others, such as Mooney et al. (2014) emphasise broader, international trends influencing justice policy in Scotland, thus questioning the distinctiveness of Scottish justice policy. Morrison and Sparks (2015:32) summarized the situation by suggesting that that accounts of Scottish distinctiveness are "difficult to evidence in their strong form". The particulars of this debate are not of direct relevance here, but this debate regarding Scottish distinctiveness suggests further caution when generalizing results regarding the manifestation of the crime drop in Scotland to other jurisdictions. This is particularly regarding the potential impact of changes in justice policy on increasing or decreasing conviction rates relative to other eras of Scottish justice policy.

The comparison of crime trends in Scotland and other jurisdictions presented in Section 3.2, however, did show notable similarities between the crime drop in Scotland and elsewhere in Europe, with a strong role played by falling crimes of

dishonesty but with less impact for other crime types. The overall picture, then, is somewhat mixed as to how typical a case study of the crime drop Scotland can be considered. Given the problems generalizing from single-country studies of the crime drop (Farrell 2013), it would be inappropriate to naively project any trends observed in Scotland onto another country. This is particularly the case regarding the potential impacts of justice policy change. However, from the studies presented in Section 3.2 it is likely that results observed in Scotland will fit better with other countries in Western Europe than in CEE or the USA. Still, any generalization of these results must be based on comparison, and an understanding of the features of both Scotland and the case to which results are being generalized (see Sartori 1991).

With these caveats acknowledged, there is still scope for the study of change in criminal careers over the crime drop in Scotland to act as a starting point in understanding the development of the crime drop internationally, and particularly in Western Europe, when the limits of generalizability from this study are understood. Even if the precise results observed in Scotland may not hold in other jurisdictions, the research design and methods discussed in the following two chapters can be adopted in other jurisdictions, and replication of this analysis is strongly encouraged.

3.7 Conclusions

This chapter has demonstrated that criminal careers concepts provide a helpful way to frame changes in patterns of conviction over the course of the crime drop, and has applied the concepts from the criminal careers literature discussed in Chapter Two to securitization, multifactor and cultural explanations for falling crime rates. This chapter has also discussed how changing justice system practices may have altered patterns of criminal careers as manifest in convictions data, and then reviewed literature describing changes in justice system practices in Scotland to understand how this context may have affected convictions data in SOI. This provides a framework for this thesis to combine analysis of criminal careers with current understandings of the crime drop. The following chapter draws on this literature review to present the aims of this thesis in exploring patterns of criminal careers over the crime drop in Scotland, and the data and research design intended to allow this thesis to address this gap in the literature.

Chapter 4. Data and Research Design

4.1 Introduction

The previous two chapters have described four concepts from criminal careers research – the age-crime curve, prevalence and frequency, polarisation and pathways of offending – and how examining change in these parameters over time can help to understand the crime drop in Scotland. This summary of the existing literature has also outlined a number of gaps that this thesis hopes to fill. The aim of this chapter is to describe the data source and research design used to adopted for this analysis which enables this thesis to fill the gaps identified in the existing literature.

This chapter begins by summarising the gaps in the literature that this thesis hopes to fill, and presenting the aims of this research and the specific research questions used to frame this investigation. Second, it introduces the Scottish Offenders Index (SOI), the data source used for this analysis. Third, this chapter outlines the research strategy adopted for this study, comparing this to the research strategies typically used in the study of criminal careers. The chapter then describes how the different concepts employed in this thesis are operationalized, before finally discussing the measures taken to ensure that this research was conducted to appropriate ethical standards.

This chapter could be considered out of order, at least based on the way in which research design is described in textbook accounts (for example, Blaikie 2009), because the discussion of the data source comes before the discussion of the research strategy adopted. This reflects the central role that the data source plays in this thesis; it is only because of the particular properties of the SOI that the research design adopted would be feasible. This also represents how this project came about as discussed in the thesis Introduction, stemming from a practical problem of data analysis using SOI. The question of change over time is only relevant due to the scope of the SOI data, and so it is most appropriate and most honest to discuss the dataset before considering the research design adopted.

4.2 Research aims, questions and strategy

The aim of this thesis is to describe trends in convictions over the course of the recent crime drop in Scotland, using a number of concepts drawn from criminal careers research, in order to better under how changes in individual patterns of

offending and criminal careers (as measured by conviction) have impacted on overall conviction trends in Scotland. In addition to this primary aim, the thesis has two secondary aims. First, this analysis aims to reflect upon the potential mechanisms driving the crime drop by considering change as due to age, period or cohort effects. Second, the thesis aims to link trends in criminal careers to changes in justice policy in Scotland. This can help to account for system effects influencing the data produced, but also potentially to understand the ways in which policy change has influenced conviction trends.

In achieving these aims this thesis fills the following gaps in the literature outlined in Chapters Two and Three:

1. Most broadly, it is not known how patterns of criminal careers have changed over the course of the crime drop. This is limitation of both the criminal careers and the crime drop literature. This thesis fills these gaps by systematically describing trends in the four criminal careers parameters outlined in Chapter Two, and by taking advantage of the span of data contained in SOI (see Section 4.3 below) to compare conviction trends for men and women of different ages.
2. The scope of the data contained in SOI allows a focus on annual change in convictions trends, a topic previously neglected in analysis of change in criminal careers over time.
3. Scotland is a case to which has seen little attention in analyses of the crime drop. Setting this research in Scotland can therefore contribute to international understandings of the crime drop as well as providing a novel way to infer potential effects of policy changes in Scotland.

To fulfil these aims this thesis answers four research questions, with one research question relating to each of the criminal careers concepts being analysed:

1. How has the aggregate age-crime curve changed over the course of the crime drop in Scotland for men and women and across crime type?
2. What are the contributions of prevalence, frequency and age-structure to falling conviction rates?

3. Has the distribution of convictions become more polarised over the crime drop in Scotland?
4. How have pathways between latent convictions groups changed over the course of the crime drop in Scotland?

The descriptive aims of this thesis are best suited to an inductive research strategy[62], focusing on questions that seek to *describe* a particular phenomenon (Blaikie 2009:83-85). Consequently these research questions are not framed as hypotheses; as Blaikie states "nothing is gained from hazarding an answer to a question that simply requires a description" (2009:10). As discussed in Chapter Three, this inductive approach is in line with the theory-generating nature of existing work exploring the crime drop, and the typical requirement for description to precede causal explanation (Gerring 2012:733). In addition, the lack of previous academic analysis of SOI also justifies an inductive, exploratory approach to understanding SOI data. The details of SOI as a data source are discussed in the following section.

4.3 Data Source: Scottish Offenders Index

The SOI is dataset collated by Scottish Government from court records. It is used to produce a yearly summary of reconviction rates in Scotland[63], and as such it contains records of convictions linked together by an anonymous personal identifier. The SOI holds data on the convicted person's age and sex and the details of their offence and conviction[64]. These features, alongside the extensive data coverage of SOI, make it a valuable resource with which to examine change in criminal careers over the crime drop.

Data coverage

With the exception of those convicted for some minor crime types (see below), the SOI contains information on every person convicted in a Scottish court. Consequently SOI forms a census of convictions, or n = all (Connelly et al. 2016). As a result it contains convictions data for the full age distribution of adults in Scotland.

62 A research strategy is the logic of inquiry used to answer research questions (Blaikie 2009:12)
63 Reports are available at http://www.gov.scot/Topics/Statistics/Browse/Crime-Justice/PubReconvictions.
64 Specifically SOI holds data on the date of offence, conviction, sentencing and disposal, the person's previous convictions (after 1989), the number of days sentenced (if a custodial sentence) and estimated release date

In Scotland children under the age of 16 are handled by a separate youth justice system (McAra and McVie, 2015) and so are not included in SOI[65]. As well as this wide age coverage, SOI also covers a wide time period. The SOI contains a record of convictions in Scottish courts from January 1st 1989 and is updated each August with convictions data for the previous year. The version used for this analysis covers the period January 1st 1989 to July 31st 2013[66]. As a result, SOI contains cross-sectional data across the full age distribution (over the age of 16). Any cases listed in the SOI which occur before 1989, or when the person was under age 16 at the age of offence[67] were excluded as they are considered unreliable (Scottish Government, 2014 personal correspondence). Cases have been excluded where the person's date of birth, date of offence or the crime type is not known[68]. Convictions relating to offences committed in 2012 were also excluded (see discussion in Section 4.4) leading to total *n* of 1,644,123 convictions covering 504,090 people. This process excluded 99,294 cases (3.7% of the total). This long period of coverage coinciding with the crime drop (see Chapter Three) which makes SOI a suitable data source for this analysis exploring trends in dimensions of criminal careers over the course of the crime drop.

As mentioned above, SOI does not cover every type of crime. SOI lists all convictions for serious violence, indecency, dishonesty, fire-raising, malicious mischief and other "serious" offences, but those for crimes against public justice, drunkenness and motor vehicle offences are excluded. A full list of offences covered is included in Appendix Three. This means that SOI, and consequently the scope of this research, does not relate to convictions of every crime type. Because of the volume of these less serious crimes, it is estimated that SOI covers between 52 and 58% of the total number of people convicted in Scottish courts. Of this discrepancy, between 79% and 86% is due to motor vehicle offences[69]. However, as this selection of crime types is consistent throughout the period covered by SOI it does not affect comparisons of convictions rates within the

65 Although it is possible for people under age 16 to receive convictions in adult courts, SOI is a less reliable source regarding convictions for those under age 16 (Scottish Government, 2014 personal communication).

66 This span is represented visually in Appendix Two.

67 As mentioned in Chapter Two this left-censoring prevents the use of the SOI to measure change in the onset of criminal careers. This time span also introduces left-censoring of convictions served to people before 1989. Such convictions are outside of the scope of this analysis.

68 As SOI is administrative data it is assumed that any missingness is completely at random (Rubin 1976), justifying the handling of missing data by exclusion.

69 Figures were calculated by comparing the total number of convictions in SOI for each calendar year with the total number of convictions reported in Scottish Government's Criminal Proceedings in Scotland reports (Scottish Government 2015).

dataset. In addition, the crime types omitted by SOI, particularly traffic offences, are not typically considered as part of discussions of the crime drop (see Chapter Three). Whilst interpreting the results of this analysis must bear this feature in mind, the exclusion of these crime types from SOI does not severely hamper the capacity of SOI to explore the crime drop in Scotland.

Whilst SOI covers all people convicted it does not cover every conviction served. As is typical of convictions datasets (Aebi and Linde 2012), the SOI only includes one record per conviction; the most serious (or 'index') offence. Thus, if a person is convicted of multiple offences in the same hearing this "principal offence rule" (Aebi and Linde 2012:108) indicates that only the most serious of these will appear in the SOI. This is described by the Scottish Government's counting rules (2015:41-42) A2 and A4[70]. As a result of this rule, each set of *proceedings* against a person is included separately in SOI, but if a person is convicted for more than one charge in a set of court proceedings only the most serious of these offences is listed in SOI[71]. SOI is therefore a census of offenders and of proceedings, but would provide an underestimate of the overall volume of crimes convicted. Again, the principal offence rule is consistent over time it should not impair comparisons made between years in the SOI, but is likely to undercount the frequency of conviction.

Taking these features together, SOI is best understood as a record of all proceedings conducted in Scottish courts for offences other than motor vehicle offences, drunkenness and crimes against public justice between 1989 and August 2013.

Value of SOI

The scope of the data contained in SOI, make this dataset a valuable resource to describe change in parameters of criminal careers over the course of the crime drop. As SOI is based on court records it does not rely on a list of the registered population, unlike Nordic register data (Lyngstad and Skardhamar 2011). However, changes in the non-resident population due to migration flows, as well as mortality amongst the convicted population, may respectively lead to attrition and right-censoring in the SOI. This is because in SOI it is not possible to tell if a period without a conviction is because a particular person has not committed a

70 See Appendix Four.
71 Precisely how cases are combined into proceedings

criminalizable act, they have not been convicted for any offences they have committed, the person has died or whether they have emigrated.

When analysing aggregate changes in convicted population, as when examining change in the age-crime curve and prevalence, frequency and age-structure, these migration trends are controlled for by using mid-year population estimates which correct for migration flows (NRS 2015:10). However, when examining conviction trends longitudinally, as in the analysis of polarisation and pathways of conviction, changes in migration over time may distort trends in onset through migration inflows (giving a misleading appearance of late-onset of conviction if a person with a previous conviction migrates into Scotland and is then convicted again) or desistance through migration outflows (if a person convicted in Scotland subsequently leaves the country and is then convicted elsewhere).

Whilst migration flows are not controlled for directly in the longitudinal analysis, examining migration patterns over the period of analysis can help understand their potential effects. Recent migration flows have a distinct age pattern, with large numbers of people moving to Scotland in their late teens to study at Scottish universities and then leave Scotland in their early twenties (National Records of Scotland 2015:45). If there is an increase in desistance transitions due to increased migration should be most prominent at the peak ages when people leave Scotland, between 23 and 25. If there is increased onset it should be seen most people arrive between the ages of 19 and 23. Moreover, migration into Scotland increased particularly after 2005 (NRS 2014:41), and so these trends should be particularly pronounced after this point. If trends in convictions pathways observed in Chapter Nine do not align with the description of migration flows above – concentrated amongst young people after 2005 – it can be assumed that observed trends in convictions pathways are not caused by changes in migration flows.

Despite these issues, administrative data suffer less attrition than longitudinal surveys (Bäckman et al. 2014), and are less prone to inaccurate recall of the timings of offences (Francis et al. 2004a:106) which may potentially bias estimates of when offences took place. As such, administrative data such as SOI are more suitable for analysing trends in crime over long periods (see also Brame and Piquero 2003). In the future data linkage with other administrative data sources could remove some of

this potential bias by, for example, linking information about mortality and emigration amongst people listed in the SOI.

Other administrative datasets than SOI could also have been used for this analysis. Nordic register data (Lyngstad and Skardhamar 2011) present another potential option for exploring change in criminal careers over the course of the crime drop. Given the international nature of the crime drop there is little intrinsic reason to give preference to undertaking analysis focusing on Scotland or one of the Nordic countries[72] However, as there has been more focus on change in criminal careers in Scandinavia to date (see Chapter Two) conducting this analysis using the previously unstudied SOI is preferred to provide another reference point for international comparison of trends. However, as the crime drop is international and aims of this analysis are descriptive, replication is strongly encouraged. A more detailed analysis of change in criminal careers over the crime drop using Nordic register data, or indeed administrative data from other countries, could be an important potential avenue for further research. Comparison of such analysis with trends observed in SOI could help to ascertain whether observed trends are common across data sources or particular to Scotland, and so provide a more direct an indication of the generalizability of the results of this thesis than that discussed in Chapter Three.

4.4 Research Strategy

The descriptive aims of this thesis are best suited to an inductive research strategy[73] (Blaikie 2009:83-85). Inductive analysis focuses on answering "what" questions and "establish[ing] limited generalisations about the distribution of, and patterns of association amongst, observed or measured characteristics of individuals and social phenomena" (Blaikie 2009:83). This research strategy has a number of implications regarding the methodology and research design adopted, as well as the scope of the conclusions that can be drawn from this analysis.

72 The availability of individual-level data from the criminal justice system varies between Nordic countries, but in Norway (Lyngstad and Skardhamar 2011:623-624), Sweden, Denmark and Finland (Lyngstad and Skardhamar 2011:624-625, footnote 11) data relating to at least some official sanctions for offending is available from the early 1990s.

73 A research strategy is the logic of inquiry used to answer research questions (Blaikie 2009:12)

Quantitative Methodology

Given the focus of this research on the description of large-scale trends over time a quantitative methodology is required. Two points should be noted here about the methodological principles underpinning the choice of methods used[74]. First, the descriptive aims and inductive approach adopted in this thesis make this analysis more exploratory (Tukey 1977) rather than confirmatory[75]. Consequently, the methods used are influenced by exploratory data analysis, relying on visual analysis of trends[76]. The exploratory approach is also in line with the lack of previous analysis of change in criminal careers over the crime drop, and the difficulty in precisely specifying how different theories of the crime drop may impact on different dimensions of criminal careers. Such uncertainty makes it difficult to specify testable hypotheses about how the mechanisms suggested different theories of the crime drop would be manifest in criminal careers. This exploratory and descriptive approach also dovetails with the indirect interpretation of latent class models discussed in Chapter Two.

The descriptive approach adopted here also fits with the nature of SOI data. As in the SOI *n=all*, typical inferential concerns about relating parameter estimates from a (random) sample to a population are not of concern here (Connelly et al. 2016) adding value to simple description of trends in the data. Consequently, results are not compared to a particular critical value, or significance tests performed to assess whether change in any of the criminal careers parameters analysed is statistically significant. Instead the focus is on describing the trends that are present in the data. When confidence intervals are presented to assist in the description of trends in polarisation and pathways of conviction (see Chapter Five) such intervals are interpreted descriptively as illustrating magnitude of year-to-year variation in trends. Using confidence intervals to illustrate volatility in trends in turn informs as to the substantive significance of change in these trends, based on the simple assertion that if the trend line has not moved beyond the confidence intervals then the meaningfulness of the change can be questioned.

74 The specific methods to be used are discussed in Chapter Five.
75 It should be noted that when working with observational, administrative data like SOI even the results of statistical models are best considered "sophisticated descriptions" (Connelly et al. 2016:6) of the data source.
76 Visual analysis is common in the study of the age-crime curve (see Tittle and Grasmick 1998).

Identifying age-period-cohort effects

The inductive nature of this analysis has implications for the assessment of APC effects. As discussed in Chapter Three, understanding the crime drop as age, period or cohort effects is vital to understand the potential mechanisms which have led to declining convictions[77]. Throughout this thesis, results attempt to determine whether change in age effects are due to period or cohort mechanisms. However, there is an inherent problem in separating APC effects statistically, known as the 'identification problem'. The this problem describes the following mathematical relationship between the terms age, period and cohort:

$$Age = Period - Cohort$$

As such it is always possible to calculate the value of one of the terms if the other two are known. This confounds statistical estimation of APC effects because a model with equal linear age, period, and cohort effects would produce the same data as a model with larger age and cohort effects and no period effects[78]. As a result, the effects of age, period and cohort on the outcome of interest (in the case conviction rates) are not estimable. Whilst a number of technical corrections have been proposed for the identification problem, such as Yang and Land's Hierarchical Age-Period-Cohort model (2013), accurately and automatically separating APC effects in a statistical model has been described as a "futile quest" (Glenn 1976, cited in Bell and Jones 2014) because the problem is at root a problem of logic rather than a problem of statistical modelling. Just because a researcher is able to fit a model with a mathematical formulation that is not confounded by the identification problem described above does not mean that this model has accurately represented the real-world phenomenon in which the researcher is interested (Bell and Jones 2014). Worse, if the researcher makes incorrect assumptions in order to produce an estimable model the results produced may be highly misleading (Bell and Jones 2017).

Given the intractability of the identification problem (Bell and Jones 2014) and in line with the exploratory approach of this thesis, rather than use model-based

77 One potential cohort effect suggested to influence crime rates is the Easterlin hypothesis, the idea that those in larger birth cohorts will have higher crime rates (Easterlin 1978). However, Levitt (1999) and Steffensmeier et al. (1992) have found little support for the Easterlin hypothesis, and so this particular manifestation of cohort effects is not focused upon in this analysis.

78 The same problem affects model specifications with polynomial effects (Bell and Jones 2014:337).

methods to assess the relative contributions of APC effects the preference here is for "informal" (Minton 2014:54) or "qualitative" (Yang and Land 2013:60) assessment. This kind of visual assessment of cohort effects is an important part of any age-period-cohort analysis, with such descriptions "almost always" providing some inference as to the age-period-cohort effects underlying a given data structure (Yang and Land 2013:6). The methods used to make this qualitative assessment of APC effects are discussed in Chapter Five. This descriptive analysis of APC effects is based on the logic of comparing of multiple age groups at multiple time points. Cook and Laub (2002:24) provide an example of this logic, suggesting that that "[a]ny "cohort" account of why violence rates have been dropping requires demonstration of a downward trend in [conviction] from one birth cohort to the next". For an effect to be a cohort effect different age groups must show different trends in the same period. Cook and Laub (2002:28) also suggest that differences between age groups must last beyond the period in question for effects to be considered cohort effects. If people of different ages show similar trends during the same period then explanations are most likely a period effect. If different age groups show different trends in a given period but then similar trends in a subsequent period these effects are most likely to be age-limited period effects. Moreover, the descriptive nature of the graphical approach aligns with the aims of this analysis to describe trends in convictions over the course of the crime drop, and as such is preferred to a modelling approach. However, formal modelling of APC effects in SOI may be a valuable area for further research, with the patterns identified using visual analysis can provide a first step towards later confirmatory analysis (Tukey 1977).

This logic of making multiple comparisons between convictions trends for different age groups in multiple periods runs throughout each of the four research questions investigated. It should be noted that these multiple comparisons required a sufficient span of data (Yang and Land 2013), and the capacity to adopt this strategy for analysing APC effects requires a particular kind of research design, discussed below.

Research design

Drawing on the flexibility of the SOI as a dataset with a repeated cross-sectional design discussed in Section 4.3 this thesis adopts a combination of research designs.

First, to analyse change in the age-crime curve an age-by-time period (Yang and Land 2013:19) design is adopted. This aggregates convictions date into an array of conviction rates for each age in each year. The same data structure is used to analyse change in prevalence and frequency. To examine polarisation and pathways of conviction a 'retrospective longitudinal' design is adopted (Francis et al. 2008). In this strategy comparisons are made between cohorts over time, with data on these cohorts being constructed retrospectively from convictions records. This design is longitudinal in that it contains data on each person's convictions over time, but this is constructed by joining together existing records rather than following a sample of people over a long period of time and recording their offending patterns (Blumstein et al. 1988a).

The flexibility of SOI to be able to use these different research designs is a significant benefit of using this data source, and demonstrates the value of administrative data for criminal careers research. The flexibility in research designs afforded by SOI exceeds that of the multi-wave cohort approach[79] to assessing social change (see Sampson 2015) by allowing comparisons across all ages in every period, which is key to assessing APC effects as discussed above. Analysis of administrative data therefore provides a helpful complement self-report offending data when analysing change over time. This ability to use multiple research designs with SOI also shows that, when using administrative data, the conflict which existed in the 1980s between those who favoured cross-sectional (Gottfredson and Hirschi 1987) and prospective longitudinal (Blumstein et al. 1988a) can become something of a false dichotomy (see also Francis et al. 2008).

Period covered by analysis

Using the research designs described above exploits the full scope of data available in SOI. Whilst the previous chapter identified that recorded crime in Scotland only fell between 1991 and 2012, this analysis covers the beginning of the SOI in 1989 to 2011. It is important to include the years 1989 and 1990 in this analysis because, different crime types peak at different times (Scottish Government 2013:7) and the number of convictions in the SOI peak in 1989. Consequently 1991 should not be seen as a discrete start of the crime drop in Scotland and so it is appropriate to

79 This strategy involves selecting multiple cohorts and then undertaking multiple survey sweeps of these cohorts. See Sampson (2015:283) for details of this strategy.

include data for 1989 and 1990 in this investigation, especially with the exploratory emphasis in this research. Convictions for offences committed in 2012 are excluded because the total number of offences committed in 2012 which had been convicted by 2013 is unlikely to be comparable to the number of offences committed in previous years which had been convicted by 31st July 2013. As the SOI only covers offences which have made their way through the process of conviction in court more recent years will exclude cases that were still be processed by the justice system which would have been included in the SOI if the data used referred to convictions more recently than 31st July 2013. Limiting the scope of the analysis to 2011 allows more even comparisons across the SOI by removing this potential source of bias in convictions rates for 2012[80].

The way that data are organized in order to answer the different research questions also impacts on the temporal focus of each results chapter. This is particularly so for the analysis of polarisation and pathways of conviction, as these analyses focus on convictions patterns over five and ten-year periods respectively (see Section 4.5). The impact of these operationalizations on the results observed are discussed in Chapters Eight and Nine respectively.

Case study design

One consequence of the descriptive research strategy adopted is that the capacity to generalize the results of this investigation are limited. A helpful way of conceptualizing this thesis, and comparing it to other studies of criminal careers, is to understand this research as a case study. Gerring describes case studies as "*an intensive study of a single unit for the purpose of understanding a larger class of (similar) units.*" (2004:342, emphasis in original)[81]. Here Scotland serves as a case study of change in criminal careers over the course of the crime drop. This understanding of the thesis is helpful as it requires a demarcation of the "wider set of similar units" to which these results are intended to relate, constraining the

80 For the SOI as a whole, 90.2% of offences were convicted within the same calendar as the offence or within one additional year. A further 7.7% were convicted within two additional years. If it is assumed that these convictions are evenly distributed across the first and second year after the offence (a conservative estimate), this would give a combined total of around 94.7% of offences committed in 2011 that are likely to have been convicted by 31st July 2013. In contrast, only around 71.5% of the offences committed in 2012 that we would expect to be convicted in the SOI if the dataset included two more years of data would be convicted by 31st July 2013.

81 A unit in this context is a "spatially bounded phenomenon" observed either at a single time point or over a set period of time (Gerring 2004:342).

capacity to generalize the findings of this study. Based on the discussion of the Scottish context in Chapter Three, the class of 'similar units' to which this case relates is best understood as other countries in Western Europe which have seen the crime drop. This suggests that results observed here are more likely to apply to other countries in Western Europe to countries elsewhere. However, this does not mean that the results of this study can be straightforwardly applied to all countries in Western Europe, as generalizing beyond the particular time and space to which data relates is always a matter of judgement (Blaikie 2009:11), or indeed that the results have no relevance to countries outside Western Europe. Any generalization must be done tentatively, acknowledging the similarities and differences between Scotland and the country to which the results are generalized (see Sartori 1991).

Thinking of this thesis as a case study of Scotland also emphasises the focus on national-level trends, rather than on understanding the typical development of individual patterns of crime with age. This framing makes a sharper distinction between the aims of this thesis and the typical aims of studies of criminal careers which are often rooted in the "social-psychological" concerns of developmental criminology (Sampson 2015:280). In particular, with this aggregate focus the current analysis differs in its engagement with criminal justice policy from that of the original *Criminal Careers* report, which focused on impact of criminal justice sanctions at the individual level (Sampson and Laub 2016:329). The interest is less on understanding the convictions patterns of particular people and more on describing the aggregate convictions patterns and the implications that change in aggregate convictions patterns has for Scotland as a whole. This helps to highlight the original contribution of this thesis as a novel exploration of these concepts, and with the national-level focus here this thesis can inform about system-level effects of policy change as discussed in Chapter Three.

4.5 Concepts and Operationalizations: Conviction, Age and Sex

This section describes how the key variables used in this analysis – conviction, age and sex – are conceptualised, and how the understanding of these variables employed in this thesis affects the interpretation of results.

Conviction

Fundamental to this analysis is the recognition that SOI data only relates to offences convicted in Scottish courts, and so the scope of this work is limited only to convicted offending[82]; the "official response to [an] offender's behaviour" (Francis et al. 2004b:54). This definition therefore excludes offences that were disposed of outside of courts, which were not reported to the police[83] or which were convicted in a different jurisdiction. As discussed in Chapter Three, changes in justice system practices can affect convictions rates present in SOI. This reflects the nature of official statistics as the product of a number of administrative processes by which conviction rates are produced (Kitsuse and Cicourel 1963). This means that conviction rates cannot be read as a direct indicator of crime rates. At the same time, it is also true that there is an empirical relationship between crime rates as convictions data do to some extent mirror offending behaviour, although at reduced volume, as the substantial majority of offences convicted in courts reflect offences which had been committed (von Hofer 2003:163). This tension can be resolved by understanding convictions data as representing both offending behaviour and official responses to this behaviour (von Hofer 2003:163). The extent of this relationship is empirical (von Hofer 2003:163) and can change over time, as demonstrated by the comparison of recorded crime and conviction trends in Chapter Three. This thesis it is attempted to distinguish between behavioural and system effects through triangulation[84] (Coleman and Moynihan 1996:132) of different type of crime data in Scotland as presented in Section 3.5, the analysis of APC effects and the comparison of convictions trends with the policy narrative outlined in Chapter Three.

This reading of convictions data as having an uncertain relationship to patterns of offending has practical implications for this analysis. First, recognizing that the selection of offences into convictions is not random, no attempts are made to scale the number of convictions to the total number of recorded crimes in order to use

82 Hereafter all references to conviction or offending relate to this definition of "convicted offending".
83 In particular, this may mean the current analysis has little to say about the development of types of crime which are poorly recorded and prosecuted, such as cybercrime (Yar 2006).
84 Ideally, triangulation across data sources such as self-reported offending would provide another way to assess whether change in convictions matched trends in other indicators of offending. Whilst this would not resolve the issue of convictions and self-reported offending measuring different constructs (as illustrated by McAra and McVie 2010a), this could at least empirically address whether the convictions and self-reported offending moved in concert. Unfortunately no such data source is available in Scotland.

convictions data as an indicator of the underlying offending rate as in Levitt (1999) and Wermink et al. (2012)[85]. Instead, the focus of this analysis is purely on describing trends in SOI. Second, the focus on convicted offending also has implications for how to interpret periods in which a person has no convictions. This is important when examining polarisation and pathways of offending, which rely on the SOI data being constructed into a retrospective longitudinal format (see Section 4.3). A zero count of convictions can comprise both 'good' and 'bad' zeros (Hilbe 2014) – zeros from errors in measurement as well as the absence of the phenomenon in question[86]. With the narrow focus on *convicted* offending and because SOI represents a census of convictions in Scottish courts, it is assumed that there are no 'bad' zeros in SOI due to a person offending but not being convicted. Sources of 'bad' zeros could come from periods when a person did not receive a conviction in Scotland because they were unable to be convicted through death, migration or imprisonment (Eggleston et al. 2004). With the current data available in SOI mortality and migration cannot be accounted for. This is a limitation of this study, and an area that future work can build upon this research. Information about time spent in prison is included in SOI, and is incorporated into the estimation of convictions groups to measure polarisation and pathways of conviction (see Chapter Five). However, given the descriptive focus of the analysis, when analysing polarisation by describing convictions trends for these groups no correction is made for time spent in prison. To do so would shift the focus of the analysis away from the crime drop as *manifest in the SOI*, which is the focus of the current research.

Types of crime

In addition to analysis of total rates convictions, in this thesis convicted offences are also divided into different types of crime. This allows assessment of change in the mix of convictions over time[87]. When split by crime type, offences are coded based on a modified version of the Scottish Government's nine-group classification of

85 There are also empirical objections to this approach. For example, this strategy would be rendered inappropriate if there was a differential relationship between offending and conviction across age (see Marvell and Moody 1991:244), or for different types of crime (Estrada et al. 2015).

86 Hilbe (2014:199) provides an example from ecology, with zero counts of bird calls during recording periods arising because 1. the birds were quiet during the time of recording (good zeros), and because 2. the recorder was in the wrong place, or at the wrong time, or the birds had been scared away prior to recording (bad zeros).

87 Gottfredson and Hirschi (1990) criticise the analysis of crime split into different crime types because they assume that the causes of all types of offending are the same. In this thesis splitting convictions by crime type does not imply any particular causal mechanisms related to offending of different crime types

offences[88] (see Table 4.1). This crime classification is amended to include Prostitution and Sexual Offences amongst Other Crimes and Offences, due to the small numbers of convictions for these crime types[89].

Table 4.1: Offences of different crime types in SOI (1989-2011)		
Crime Type	N	Percentage
Violence	340,451	21.11
Dishonesty	521,607	32.25
Criminal Damage	104,601	6.49
Drug Offences	141,792	8.79
Breach of the Peace	383,899	23.81
All other Crimes and Offences	120,041	7.44
Total	**1,612,391**	**100**
Source: SOI. Note: This classification differs to the Scottish Government's five-category crime classification used in Figure 3.1.		

The small numbers of people with convictions for these crime types gave a large amount of variability in these trends, particularly when examined for different ages, hindering meaningful analysis of how these trends had changed over time. For the same reason, the decision was made not to model convictions at the level of the offence code. The use of different offences codes over time has much more volatility (see trends in Appendix Five) than the crime types employed here, with legislative changes move offences under different codes, and many offences codes have very few convictions. Where appropriate, analysis by offences coded at the level of the offence code are presented in Appendices to examine variation within these categories. This use of the Scottish Government's crime categorization is similar to Bartolucci et al.'s (2007) use of the Home Office's convictions groupings for their analysis of transitions between latent convictions classes in the England and Wales Offenders Index. Exploring trends in criminal careers using different kinds of crime classifications, for example, based on the frequency of convictions within SOI, may be a fruitful avenue for future research, but in this exploratory stage the preference was to use an established classification.

88 This differs from the Scottish Government's five group crime classification (used in Figure 3.1). The five group classification includes two miscellaneous groups (fire-raising, vandalism etc. and other crimes), and so the greater specificity of the modified nine-group classification was preferred.

89 There were 9,090 convictions for prostitution and 10,924 convictions for sexual offences in the SOI.

Demographic variables

There is substantial debate about what causes observed differences in offending and conviction between men and women (Moffitt 2002) and for people of different ages (Hirschi and Gottfredson 1983:552). Given the descriptive focus of this thesis, no assumption are made to as to the underlying cause of observed differences in convictions patterns between men and women or between people of different ages. The use of age and sex as variables in this thesis is compatible with a number of theoretical conceptions of the impact of these factors – or variables correlated with these age and sex – upon both offending behaviour and the decision of courts to convict people of different ages.

Age

The age used for this investigation is the person's age in years at the time of offence. As a result, the scope of the data are all offences committed between the years 1989 and 2011 (inclusive) for which an individual was convicted in a Scottish court between 1989 and 31st July 2013. Age at offence was preferred to using the person's age at conviction, as a person's age at conviction is affected by different lengths of follow-up, investigation and prosecution between members of the dataset[90]. For example, measuring a person's age at time of offence rather than at time of conviction eliminates the impact of pseudo reconvictions – "convictions which occur after the index conviction, but relate to offences committed prior to the index conviction." (Scottish Government 2015:41) – and so reduces potential bias in the description of the relationship between age and convicted offending which could be introduced by differing lengths of time to prosecution.

When examining the combined effects of prevalence and frequency it is necessary to control for change in population composition. This requires measuring the age distribution of the population. This distribution is operationalized as the population age-structure, which shows the proportion of people in the population of a given age. In addition to standardizing by age-structure it is also possible to standardize by population size (Rosevear 2010:285-287). Using age-structure the emphasis on the shape of the population (rather than the size of the population), and consequently allows the analysis to focus on change in the overall *rate* of convicted offending rather than on the volume of convicted offending. This makes the results of the standardization and decomposition more comparable over time, and also more comparable to the analysis of change in the

90 Similarly, Skardhamar (2010a:26) uses the age at the time of offence when working with Norwegian register data.

age-crime curve, which also analyses conviction rates rather than numbers (see Section 4.5). To assess the robustness of findings using population structure rather than population size, Appendix Six presents the equivalent results calculated using numbers of people of different ages (rather than the proportion of the population of each age), which gives an estimate of the total number of convicted offences, rather than the convicted offending rate. Results of these two methods were substantively similar (see Section 7.3, footnote 126).

Sex

The SOI contains information on the offenders' sex, coded either as male, female or missing. Table 4.2 presents descriptive statistics for sex variable in SOI. As anticipated, the substantial majority of those convicted in the SOI are coded as male (81.3%), with a much smaller proportion coded as female (18.6%). Seventy-eight people in the SOI had missing data on this variable, and 237 were listed as either a man, women or missing at different time points. Appropriately interpreting these cases with multiple codes for sex is an important issue. Based on the SOI it is not possible to know what has led to this use of multiple codes: a change in the person's sex, a person's rejection of a particular kind of gendered identity, or an error in data entry. It would be highly inappropriate to assume and impose a particular trans identity on any of these people given the complexity of the relationship between administrative data and LGBTQ identities (Johnson 2014) and the limited information contained in the SOI. As such convictions for these 315 people are excluded from the analysis.

Table 4.2: Sex of people listed in SOI (1989-2011)

Sex	N	Percentage
Men	402,455	81.32
Women	92,163	18.62
Missing	78	0.02
Multiple codes used	237	0.05
Total	**494,933**	**100**

Source: SOI

4.6 Concepts and Operationalizations: Dimensions of Criminal Careers

Following on from the previous section, Section 4.5 outlines how the four criminal careers concepts (the age-crime curve, prevalence and frequency, polarisation and

pathways) are defined and measured and the rationale for the approach taken. The specific methods used to investigate change across these parameters are discussed in Chapter Five.

Age-crime curve

For this study the age-crime curve (ACC) is defined as the age distribution of the proportion of people in Scotland convicted in Scottish courts in a given year. When examining change in the age-crime curve over time, conviction rates are presented as age-specific rates of convicted offences per 10,000 population[91]. Presenting the ACC as a conviction rates helps to account for population change over time (Farrington 1986). These rates provide estimated population figures for each age in each year based on census data[92]. Because at older ages there are very few convictions analysis focuses on ages 16-65. Whilst population estimates do not provide a perfect denominator to calculate crime rates for each age – they are, after all, estimates (see Farrington 1986:194-195) – the mid-year population estimates provided by NRS are the most suitable way to account for population change over time.

The definition of the ACC as employed here focuses on prevalence, rather than the combined effect of prevalence and frequency. This is because age is a property of people rather than a property of convictions, and as such it makes more sense to describe properties such as the mean age of conviction (see Chapter Five) in terms of prevalence rather than prevalence and frequency. In addition, this operationalization examining conviction rates is preferred to an alternative specification of the age-crime curve used by Steffensmeier et al. (1989) and Ulmer and Steffensmeier (2014): Percentage Age Involvement (PAI). PAI standardizes the crime rate for each age in each year by the total volume of crime in that year. The resultant PAI is therefore the contribution of each age to the total volume of crime in a given year. However, the specification of PAI standardizes for change in the total volume of crime, which is the key focus of this thesis. Allowing conviction rates to

91 These population estimates come from the National Records of Scotland (NRS) (2014). In October 2015 the Scottish Government identified an error in the estimation of mid-year population estimates between 2002-2010 and 2012-2014. However, the impact was considered sufficiently small that estimates for 2002-2010 are recommended to continue to be used without revision (National Records of Scotland: Population and Migration Statistics, 2015).

92 Age-specific populations estimates are calculated for years between censuses accounting for births, deaths, net migration, the population in the armed forces and the population in prison (NRS 2015:10).

vary across years gives the analysis a more direct link to the total numbers of convictions in a particular year, and so allows a better understanding of the crime drop in Scotland.

Prevalence and frequency

Prevalence is understood as the proportion of people with a convicted offence within a calendar year, expressed as a rate per 10,000 population. This is analysed both as rates of all people and all convictions as well as in age-specific rates. This definition draws on Blumstein et al.'s conception of prevalence[93] as distinguishing between "active offenders from nonoffenders in a population" (1988a:4). The measurement of prevalence is the same of that of the ACC described above[94]. Frequency is defined as the average number of convictions served to those who are convicted (see Blumstein et al. (1988a:4). Frequency is measured as the mean number of convictions per person of each age convicted in a given year. This is a population average measure of frequency (Gottfredson and Hirschi 1987), and does not account for time people may have spent in prison.

The frequency of conviction as measured in the SOI is likely to underestimate the total number of crimes for which a person is convicted due to the principal offence rule. This compounds the effect of lower frequency from convictions data than self-report data, as fewer convictions are served than there are crimes committed, and in SOI fewer convictions are recorded than crimes convicted (see Section 4.3). This is an important point to note, particularly when comparing estimates of the frequency of conviction in SOI with the findings of Berg et al. (2016) who measure frequency using self-report data. However, given the substantive focus on conviction rather than offending as discussed in Section 4.1, the expectation of lower frequency of conviction than frequency of offending is not a significant limitation for this analysis. Moreover, comparisons of the impact of the frequency of conviction made *within* the SOI over time should not be impaired, as the principal offence rule has been consistently applied[95]. As such change in frequency over time can still be meaningfully analysed.

93 Blumstein et al. (1988) prefer the term participation to prevalence, but the meaning of the terms as used here is interchangeable.
94 ACC simply describes the distribution of age-specific prevalence rates.
95 The earliest available documentation describes the SOI as operating on the principal offence (Scottish Executive 2001:21).

The definition of frequency used here is preferred to the rival conceptualization of frequency offered by Gottfredson and Hirschi (1987:228) who suggest that a more useful indicator is the total number of crimes divided by the whole population, rather than just the number of people convicted. Gottfredson and Hirschi's (1987) suggestion is based on their belief that of primary concern to criminologists is the difference between non-offenders and offenders, rather than the rate of offending by offenders. However, keeping prevalence and frequency distinct in this analysis allows the exploration of different contributions of these two factors to change in conviction rates over the course of the crime drop. This is a key aim of this study, and also of theoretical importance (see discussion in Chapter Two). Consequently the definition of frequency provided by Blumstein et al. (1988a) is preferred to the composite measure as proposed by Gottfredson and Hirschi (1987).

Polarisation

As outlined in Chapter Two, polarisation refers to change in the mix of high-rate and low-rate offenders among the convicted population. In this thesis polarisation is defined as either an increase in high-rate latent class(es) as a proportion of all people convicted or an increase in the proportion of total convictions served to the high latent class(es). Conversely, this can be described as a fall in the proportion of people grouped into the low-rate latent class(es), or the proportion of convictions attributable to the low-rate class(es). This definition refers both to the proportion of high-rate *offenders* in the population and the proportion of overall *convictions* served to this group(s). The proportion of convictions of different crime types served to members of different classes over time are also analysed. This helps to identify whether changes in the membership of the classes produced by the LCA are related to changes in the prevalence of particular types of crime, and whether any changes in the distribution of convictions of different types are evenly spread across latent classes. Class membership is analysed as a proportion of of the convicted population in order to hold constant changes in the prevalence of conviction, concentrating on the relative size of different conviction groups within the population of those convicted. Interpreting these trends in the light of changes in the prevalence of conviction (as explored in Chapter Six) can show both relative and absolute change in the size of different conviction groups.

The group(s) of high-rate offenders[96] used to assess polarisation are identified using Latent Class Analysis (McCutcheon 1987). The details of this method are discussed in Chapter Five, but broadly speaking LCA allows groups to be identified based on their convictions patterns. To ensure that the definition of the high-rate conviction group(s) is consistent over time, LCA is estimated using data for all years and men and women of ages in a single model. As discussed in Chapter Two, this specification is likely to include fewer women in any 'high-rate' group than if the model was constructed for men and women separately. The benefit of estimating the model on the whole dataset rather than splitting the data by sex is the consistency in the definition of groups that this approach provides. As SOI is understood as a census of conviction (see Section 2.3) in Scotland, it is assumed that the only uncertainty regarding the membership of different latent class groups is the probability of class membership (see discussion in Chapter Five). Based on the nature of SOI as discussed in Section 4.3, latent class groupings are understood as population parameters rather than sample parameters, and so are interpreted as being measured without error. As a result, polarisation is assessed only with reference to the proportions of men and women in different classes, without reference to confidence intervals for these estimates[97].

Defining groups of offending – and so measuring polarisation – using LCA was preferred to alternative methods, such as selecting a threshold for the number of offences committed, because this method allows groups to be identified without determining a cut-off point between high-rate and low-rate offenders *ex ante* (Nagin 2004), avoiding arbitrariness in the definition of different groups. Estimating the model on data for all ages and all years simultaneously provides a uniform specification for the different latent classes over time, allowing comparison of polarisation using a consistent definition of the different conviction groups. LCA can also classify people based on both type of crime as well as frequency of conviction, which is an important factor to consider given the contrast in convictions trends for different crime types seen across Western Europe (see Chapter Three). Creating

96 Whilst groups produced by LCA are dependent upon the dataset used, from previous research (see Jennings and Reingle 2012) it is assumed that a high-frequency group will be identified.

97 This is a different interpretation to that of McVie, Norris and Pillinger (forthcoming) who estimate confidence intervals for membership of latent classes based on victimization data in the Scottish Crime and Justice Survey. These different approaches are based on McVie, Norris and Pillinger's (forthcoming) use of survey data rather than administrative data, as well as their aim in modelling counts of victimization, whilst this thesis uses LCA to focus on the assignment of people to latent classes (see Chapter Eight).

groups using LCA therefore allows the identification of groups marked by particular types of conviction, who may have a prominent role in driving falling convictions, if the data indicate that such groups help to appropriately summarize the data[98].

In addition to the technical specification of polarisation in this thesis, it is important to note that the way groups of high-rate offenders are discussed is almost as important as the way they are defined. As David Greenberg notes, discussion of "career criminals" can easily lead to misinterpretation, especially for those who are not specialists in criminology (1991:40). The potential results of these misunderstandings are the stigmatization of a group of people as career criminals, in need of early and preventative incarceration. Greenberg's concerns speak to the way that potential policy implications of criminal careers research are framed, as much as the concept of the career criminal or frequent offender *per se*, his criticism is particularly focused at studies with a predictive aim rather than the descriptive aims of this analysis. However precision in language is still crucial in this study as so to avoid unwittingly suggesting causal distinctness for this group, and as a result members of high rate latent class group(s) identified are not described as "high rate offenders", but rather as being classified into a high rate group.

Pathways of conviction

The concept of convictions pathways used in this thesis provides a summary of a trends in persistence, desistance and onset. Pathways of conviction are defined as movement between latent convictions classes in consecutive five-year age-bands.

As a result of this definition, the matrix of possible pathways relies on the classes constructed by LCA. Pathways are examined using pairs of consecutive age-bands (for example, a person's conviction class at age 16-20 and at age 21-25) and so each pathway describes a person's latent class membership across a 'transition point' - that is, the age that marks the breaks between age-bands. Changes in pathways of conviction are measured by the proportion of men and women of different ages who make the different possible transitions in different years. These proportions are examined prospectively (as a proportion of moving out of each convictions class in the younger age-band) and retrospectively (the proportion of people moving into

98 See Chapter Five for the details of how classes are constructed in LCA.

each convictions class at the older age band) at each transition point. Trends are described first as whether a person was convicted or not in the two age-bands at a particular transition point, and then using the latent class groupings used to described polarisation (see above) to explore people's movements between conviction classes.

The terminology and measurement of pathways as adopted here is based on the usage of the term by Francis et al. (2004b:76-78), who use 'pathway' to describe the movement between latent convictions groups over time. Francis et al. (2004b) provide an example of describing the conviction pathways of each man classified into the "vehicle theft" class in their dataset at age 16-20, and describing which conviction groups these men were classified when they were under age 16 and between age 21-25. This illustration is helpful in illustrating both prospective (groups people *move into* after a given point) and retrospective (where people have *come from* to reach a given point) perspectives on conviction pathways. Following people prospectively after they have received a conviction can give an understanding of persistence and desistance, and analysing pathways retrospectively can explore onset[99] of conviction. Robins' paradox (1978) suggests that these two perspectives can give different understandings of continuity and change in convictions patterns, and so both of these approaches can provide important information here. Examining both perspectives can therefore explore both movements into, through and out of the justice system as reflected in SOI data.

One limitation of Francis et al.'s (2004b) approach is that it requires the use of three age-bands (i.e. fifteen-years) worth of data to describe movement into and then out of a specified reference class. This reduces the number of pathways it is possible to analyse in SOI. Instead, analysing movement between convictions classes in single

99 When measured in this way an "onset" pathway a person having one five year period with no conviction and followed by (at least one) conviction in the next five-year period. This includes people who may have had convictions in a previous five-year window. For example, if a person received a conviction at age 16, then no convictions between the ages of 21 and 25 but a further conviction at age 26 this person would contribute one 'desistance' transition (at age 21) and an onset transition at age (26). There is a debate in the literature (see Beckley et al. 2016; Sohoni et al. 2014; Eggleston and Laub 2002) as to whether a conviction in adulthood is likely represent 'true' onset of offending or the late manifestation of adolescent antisocial behaviour. As this analysis focuses only on conviction, no assumptions are made either way as to whether people who display onset pathways are showing true onset of offending. Instead this term used here to describe people who resume contact with the justice system after a five-year period without a conviction. Approximately 35% of men and 20% of women who were classified as making an onset transition at age 26, 31 or 36 received a previous conviction listed in SOI.

transition points requires only ten years worth of data. Moreover, unlike the example provided by Francis et al. (2004b) this approach does not require the selection of a particular class of interest, instead examining movement between all convictions classes. This gives an overview of population trends in transition between conviction classes, which aligns with the aim of this thesis to understand changes in criminal careers over the course of the crime drop. Examining transitions between different latent classes can give an indication whether trends are general or relate particularly to people with particular kinds of convictions patterns as identified by the LCA. This approach also allows the simple comparison of trends between ages and in different periods, allowing an assessment of whether observed trends are likely to be period or cohort effects.

One limitation of this definition of pathways is that it limits the scope of this analysis to cohorts born before 1986. This is because each transition point represents conviction data covering ten years (that is, two five-year age-bands). As a result, this analysis is limited in its capacity to explore changes in pathways of conviction after 2007. Whilst this is a limitation of the current study, this kind of right-censoring is an inevitable feature of longitudinal analysis. A further limitation of this definition and measurement of pathways is that very sparse trends can be produced if classes estimated by LCA are small. As a result, Chapter Nine reports only on pathways which were considered substantively important to understanding trends in convictions patterns. Results for all pathways are presented in Appendix 23. Displaying results in full in Appendix 22 is based on the principle of transparency, which is key to quantitative analysis (Rosnow and Rosenthal 2013). It is to the subject of research ethics that this chapter now turns.

4.7 Ethics and Data Access

In addition to the technical aspects of research design as discussed in this chapter, as with any piece of research there are ethical implications for the analysis conducted in this thesis. Rosnow and Rosenthal (2013) list five ethical standards common to all research and five ethical standards particular to quantitative research. These common standards and quantitative standards are discussed below, and it is demonstrated that this thesis adheres to each of these standards.

Five Ethical Standards

Rosnow and Rosenthal (2013:44-45) list five ethical standards as:

1. *Beneficence*. Maximise the possible benefits of research.
2. *Non-maleficence*. Do not harm during research.
3. *Justice*. People should not be denied a benefit to which they are entitled (without good reason), and should not have burdens placed upon them unduly.
4. *Integrity*. Research should be conducted honestly, without incurring excessive cost and whilst disclosing any conflicts of interest.
5. *Respect*. People should be treated as autonomous agents, and those with diminished autonomy should be respected.

Many of these ethical standards relate to how participants are treated during research, which can be seen from the focus of the non-maleficence, justice and respect standards. Performing secondary data analysis minimises some potential problems in these areas (Dale et al. 1988). However, working with administrative data presents its own particular legal and ethical issues (see Laurie and Stevens 2014, 2016). Connelly et al. (2016:6) note that a key part of working with administrative data is the adherence to conditions set out by the data holders in the data access agreement. Access to SOI data was covered by a data sharing agreement between the author and the Scottish Government. As a condition of this agreement, SOI was kept in a secure environment provided by the University of Edinburgh, and in the first instance was transported using an encrypted device. This ensured that access to the data was limited only to the author and the named parties in the data sharing agreement[100]. Research outputs were checked by Scottish Government to ensure that no individuals were able to be identified (Connelly et al. 2016:6), and SOI itself is anonymised so that individuals could not easily be identified from SOI data. These steps helped to ensure confidentiality of people who convictions records are listed in SOI. Together, these steps help to fulfil the non-maleficence and integrity standards. Using administrative data also helps to fulfil the integrity standard by minimising the cost of data collection (Connelly et al. 2016:5). Finally, the beneficence standard is achieved through the successful completion of the research and presentation of the policy implications of the results (see Chapter Ten).

100 These were the author, Prof. Susan McVie and Dr. Paul Norris who were granted permission to access the data in their role as thesis supervisors.

Five Standards for Quantitative Analysis

Rosnow and Rosenthal (2013:45-46) suggest quantitative analysis should display:

1. *Transparency*. Results are presented candidly with minimal technical language, and data visualisations are chosen appropriately.
2. *Informativeness*. Readers have sufficient information to "make up their own minds" about the conclusions of analysis on the basis of primary results and can re-analyse secondary results for themselves
3. *Precision*. Results "should be reported to the degree of exactitude required by the given situation", avoiding false or meaningless precision.
4. *Accuracy*. Mistakes in reporting should be corrected and false claims should not be made about the application of results.
5. *Groundedness*. The choice of methods should be appropriate to the research questions investigated.

The results presented in this thesis adhere to these five standards. The rationale for the selection of data visualisations (transparency) and methods (groundedness) are discussed in the following chapter. The standard of informativeness is met by presenting results as fully as possible, including presenting full results or results using different model specifications in Appendices. In addition, efforts have been made to ensure that results are robust and not sensitive to the methods selected, running models with different specifications and assessing their results (a form of sensitivity analysis, see Pannell 1997). To ensure precision, results in tables are not presented to more than three decimal places. Discussion of graphical results depend on the scales and type of visualization used for the analysis, but care is taken not to over-interpret figures. This is discussed further in the following chapter. The standard of accuracy was adhered to by being clear about the limitations of the analysis (see Chapter Ten), as well as ensuring that the way in which groups produced by LCA are discussed. In particular, being clear that latent classes do not represent groups of people with distinct causal mechanisms leading to their conviction patterns is important both for the inferences made from results but also to avoid spurious policy recommendations or stigmatization of people classified into particular groups (see Greenberg 1991:40). This also helps to fulfil the ethical standards of non-maleficence and justice.

4.8 Conclusions

This chapter began by outlining the key aims of this thesis based on the gaps identified in the literature reviewed in Chapters Two and Three. It was contended that there was a need for an exploratory approach to describing patterns of criminal careers over the course of the crime drop, and that this thesis aims to fill this gap as well as using this description of change in criminal careers to reflect on theories of the crime drop and the development of justice policy in Scotland. This chapter has presented the four research questions this thesis seeks to answer, and outlined an inductive research design and quantitative methodology as most suitable to answer these research questions. Importantly, this chapter has also shown how important features of this analysis, such as the examination of APC effects, can be undertaken using descriptive analysis and drawing on the scope of data provided in SOI. The chapter has also shown that, because SOI represents a census of people convicted in Scotland, the analysis of criminal careers presented in this thesis can be seen as focused on Scotland as a country, rather than on the development of individual criminal careers. This is an important distinction between the current analysis and the typical focus of criminal career studies, and this novel use of criminal career studies can be seen as an original contribution of this thesis to the criminal careers literature.

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The following chapter builds on this description of the research design adopted in this thesis by presenting the specific quantitative methods used answer the four research questions presented here.

Chapter 5. Methods

5.1 Introduction

The previous chapter detailed the aims of this thesis – to describe change in criminal careers over the course of the crime drop – and the research design adopted to fulfil these aims. The current chapter complements this research design by describing the specific methods used to answer the research questions listed in Chapter Four. The sections in this chapter each focus on a particular method or combination of methods. The chapter follows the order of the four research questions outlined in Chapter Four, with each method/combination of methods being used to answer a particular research question. These methods match closely with the four criminal careers concepts which inform this thesis (the age-crime curve, prevalence and frequency, polarisation and pathways of conviction). The sections in this chapter first describe how the particular method works, how it is employed in this thesis and finally discuss the rationale for the selection of the method as opposed to alternative possible methods. In doing so this chapter shows how this research fulfils the standard of groundedness in quantitative analysis (Rosnow and Rosenthal 2013:46) by illustrating how the methods used are appropriate to answer the research questions of this thesis.

The first section of this chapter discusses data visualizations and descriptive statistics used to explore change in the age-crime curve over time in Research Question One. The second section describes standardization and decomposition techniques used to partition overall change in conviction rates into the contributions from prevalence, frequency and age structure to answer Research Question Two. The third and longest section describes the operations of Latent Class Analysis which is used to construct different convictions groups based on people's rate of conviction of different crime types. These groups form the basis of analysis of polarisation (Research Question Three) and pathways of conviction (Research Question Four). The procedure used to examine movement between these convictions groups over time to analyse pathways of conviction is the focus of the final section of this chapter.

5.2 Data visualization and descriptive statistics

To describe change in the age-crime curve both data visualization and descriptive statistics are used. Visualization provides a simple way to assess overall trends in data, and in combination with descriptive statistics can provide a fuller picture of the shape of a distribution than descriptive statistics alone (Anscombe 1973). As such both methods are employed here.

Data visualization

The main use of data visualization in this thesis is to examine change in the age-crime curve over time. Plotting the age distribution of conviction has often been used as a method of assessing change in the distribution over time (see Hirschi and Gottfredson 1983, Farrington 1986, Tittle and Grasmick 1998). However, the interest in annual change in the prevalence of convicted offending across both age and time renders standard data visualizations, such as line plots, unwieldy. Typically such plots feature age and the conviction as the y axis and age as the x axis, with different years represented by different lines (e.g. Kim et al. 2015, Farrell et al. 2015). Examining change in different years can also be achieved by plotting time as the x axis, conviction as the y axis and representing different age groups with different lines (e.g. Morgan 2014). However, such approaches typically require the use of either disparate time points or wide age categories, making it difficult to examine nuanced trends. The problem arises because line plots offer only two dimensions (x and y), whilst the aim of such analysis is to explore the effect of a third variable – time (z) –on the relationship between x and y. The inclusion of this third variable quickly increases the volume of data being analysed rendering line plots ill-suited to exploring change in the distribution of x and y across a large number of time periods.

In this analysis the preferred method to incorporate change over time into the visualisation of the age-distribution of conviction is to use shaded contour plots (Vaupel et al. 1987; Minton 2014). Shaded contour plots provide a way to analyse changes in a particular variable (z) across age (x) and year (y). By arranging age and year as a surface, the dependent variable (z) for a particular age in a particular year can be read as the 'height' of the surface. In a shaded contour plot, rather than presenting the convicted offending rate as a number the convicted offending rate is

coded to a colour scale, with higher rates being represented by, for example, darker shades. Change in height across the 'surface' of convicted offending rates can thus be rendered as contours linking similar values together. As on a topographic map, these contours can be labelled to show the values that are connected and the surfaces can be shaded to help distinguish between high and low values (Minton 2014). These are akin to what Farrington (1986:205) describes as "age-year" tables, which present information about conviction rates in a table with year in columns and age in rows, with each cell containing the conviction rate for the particular age in the particular year. Unlike "age-year" tables, which would quickly become unusable with large volumes of data, shaded contour plots are designed to represent values over large spans (Vaupel et al. 1987). Contour plots therefore give a holistic view of change in the age-crime curve, rather than a selective, partial view provided by analysing age-crime curves from selected years using line plots. This facilitates comparison of data across multiple years in the same chart, and thus allowing the informal examination[101] of age, period and cohort effects (Minton 2014).

Figure 5.1 illustrates how to distinguish between age, period and cohort effects within a shaded contour plot. With year running across the horizontal axis, and age in years running across the vertical axis, the dashed vertical lines indicate each year from 1990 to 2010 at five year increments, the solid horizontal line indicates the ages from 20 to 60 years at five year increments, and the dotted diagonal lines indicate a range of birth cohorts, each also separated by five years. Purely period effects are therefore identifiable as changes in the surface of cells when viewing the image from left to right or right to left; age effects as changes in the surface when viewing bottom to top or top to bottom; and cohort effects are changes which occur primarily along the diagonal lines.

Given the typical shape of the age-crime curve as discussed in Chapter Two, we should expect a preponderance of horizontal lines due to the strong age effect of the age-crime curve. Consequently, deviation from horizontal contours show change in the shape of the age-crime curve. This also complicates the interpretation of the contour plot, as the strong age effect means that interactions between age and period

101 This examination is informal because it is not based on a statistical model.

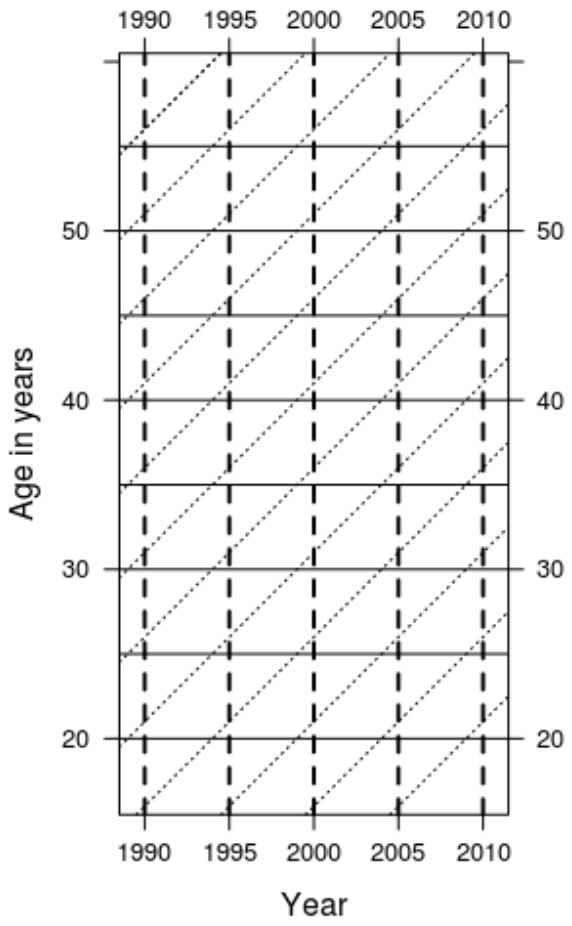

Figure 5.1: Assessing Age, Period and Cohort effects in a shaded contour plot

and age and cohort are more likely than direct effects of period or cohort. Whilst the age and period interactions are conceptually difficult to distinguish from cohort effects (Cook and Laub 2002), contour lines which show diagonal deviations from the horizontal represent an interaction between age and period. Similarly, vertical lines may show an interaction between age and cohort, although these too are difficult to distinguish from period effects. As such, any determination as to whether observed trends are period effects or age and cohort interactions, or cohort effects or age and period interactions cannot be made definitively. That said, given the strong age effect typically observed on convicted offending, the likelihood of deviations in contours representing interactions with an age effect is perhaps greater than a pure period or cohort effect. One way to help distinguish these factors is if deviations

from horizontal contours are observed for all ages in a given year. If there is change across all contours in a given year this implies a general (i.e. not age-specific effect) period effect. In contrast, deviations only for some contours imply age-localized effects. For example, vertical contours observed for only one part of the age distribution may represent cohort effects interacting with the typical age effects of the age-crime curve.

Descriptive statistics

Analysis of descriptive statistics provides a helpful complement to data visualization. Descriptive statistics reduce a distribution to a single value describing one of its properties, and as distributions which have the same values in one measure may differ by another measure (Farrington 1986:195), using multiple descriptive statistics allows the examination of different ways in which the age-crime curve has changed. The statistics used are those recommended by Farrington (1986) to assess change in the age-crime curve over time. These are:

- *The mean, median and modal age of conviction*. These measures provide an indication of where the centre of the distribution is
- *The skew and kurtosis of the distribution*. Skewness measures how symmetrical a distribution is, with positive values showing a distribution with a longer right-tail, and more mass concentrated on the left-hand side of the distribution. The typical age-crime curve is positively skewed (Farrington, 1986), which is likely to be exacerbated in SOI as the data begins at age 16, and so the distribution's left-tail is artificially truncated. Kurtosis measures how much a distribution is peaked around its centre. The more the mass of the distribution is concentrated around the peak value the higher the kurtosis. Kurtosis is measured relative to the Normal distribution (with mean zero and standard deviation of one). Here a kurtosis value of zero is the amount of peakedness present in a normal distribution.
- *The convicted offending rate at the peak age of convicted offending*. Change in the offending rate at the peak age illustrates change in the scale of the distribution.
- *The age at which the convicted offending rate drops to half of its rate at the peak age* (hereafter referred to as half peak age). This measure gives an

indication of how broad the peak of the distribution is (Farrington, 1986:196). Due to the left-censoring in the SOI (see Chapter Four) this measure focuses only on the half peak age after the peak age of conviction.

- *The 25th and 75th percentiles of the distribution*. These measures describe the dispersion of the distribution.
- *The standard deviation of the distribution*. As with the 25th and 75th percentiles, the standard deviation provides a sense of how dispersed the distribution is.

Implementation

Both shaded contour plots and descriptive statistics are are used to show change over time in the prevalence of convicted offending over age in Chapter Six. Contourplots plots are also used to demonstrate change in the frequency of convicted offending and change in Scotland's population structure in Chapter Seven.

Contour plots

Shaded contour plots were created using R 3.2.4 and the contourplot() function in the lattice package (Sarkar, 2008). To convert numeric values of convicted offending into a colour scale to act as the plots' *z* variable, for each plot the maximum value of z is calculated. The number of 'cuts' - the divisions in the colour scale produced by the contourplot() function - is then set to this maximum value. For conviction rates the cut value is set to be equal to the maximum rate per 10,000. Given the smaller distributions for these variables, for frequency cuts is set to the maximum frequency * 100 (e.g. maximum frequency of 1.8 = 180 cuts) and for population structure the numbers of cuts is equal to the proportion of population * 100.

One limitation of contourplots is that they can be overwhelmed with detail when there is a lot of variation between neighbouring cells, as often the case with rare events. In such cases it is recommend to adopt a smoothing procedure to reduce the cell-to-cell variation and thus highlight the key trends in the data (Parkinson et al. 2017, supplementary material). For this analysis, smoothed values were produced using a Gaussian smoothing procedure with the blur() command in the R package spatstat() (Baddely et al. 2015) and implemented using the function written by Minton (2016). Key to this smoothing process is the selection of the smoothing

parameter which determines the 'width' of the window over which values are smoothed. Higher values lead to more smoothing and lower values lead to less smoothing. In this analysis a low value of 0.7[102] was adopted to maintain the detail in convictions trends whilst removing extraneous noise. To allow the reader to assess the effects of the smoothing procedure, unsmoothed figures are presented in Appendix 21.

Contours are added to each plot to aid interpretation. The levels of the contours in a given plot are marked on the scale to the right of each figure. The level of the contours in the different plots is dependent on the distribution of the *z* variable, with levels chosen to keep the maximum number of contours between three and six in order to both highlight the key features of the data but avoid confusion by overwhelming the individual cells in the plots. The contours are again based on the smoothed values. To further aid interpretation, reference lines for age, period and cohort are added to the contour plot as in Figure 5.1, and figures are presented isometrically so that cohorts run at a 45 degree angle.

Descriptive statistics

Descriptive statistics are calculated for the age-crime curves for the first and last years covered by SOI and for different types of crime to analyse where the shape of the distribution has changed over time. This analysis is performed for men and women separately.

Rationale

The selection of both shaded contour plots and descriptive statistics as methods to explore change in the shape of the age-crime curve over time, and so to answer Research Question One, come from the nature of SOI and the aims of this analysis. As discussed in Chapter Four, SOI is conceptualized as representing a census of convicted offending for particular types of crime in Scotland. With little potential for trends in descriptive statistics to reflect bias from sampling variation, descriptions of the sample can be considered informative in themselves rather than relying on inferential statistics to generalize from a sample to a population (Connelly et al. 2016). In addition, visualization was preferred to formal statistical comparisons of

102 Parkinson et al. (2017) list 0.7 and low and 2 as high smoothing values.

age-crime curves from different years because the aim of this analysis is not to formally test whether distributions are statistically different (see for example, Britt 1992), but to see where across the distribution the change implied by falling crime rates had occurred. As described above (see also Chapter Four), this visualization approach also allows the informal estimation of age-period-cohort effects. As such, the combination of visual analysis and descriptive statistics are the most suitable methods to answer Research Question one, as opposed to testing statistically whether the age-crime curve in SOI has changed over time. It should be noted however, that this approach brings a necessary caveat that trends identified in the data are only descriptions of patterns in the data, and cannot be considered 'proof' that the mechanisms which led to these patterns are definitively age, period or cohort effects.

5.3 Standardization and Decomposition

Standardization and decomposition are related methods which remove compositional effects from the overall rates of a particular phenomenon (such as convicted offending) in two or more comparison populations (for example, between different years) (Das Gupta 1994:171). As employed here, these techniques calculate the difference in convicted offending rates between comparison years due to differences in their age-specific prevalence and frequency rates and their population structures.

This approach begins with standardization. Standardization first calculates one population composition as a baseline, for example an age-structure,. Convicted offending rates are then recalculated across the years being compared by replacing their respective observed age structures with the baseline population age structure (Das Gupta 1993:1). This provides the convicted offending rates for each comparison year standardized by age-structure. This process is then repeated for prevalence and frequency. In this way standardization removes differences in convicted offending rate between comparison years due to differences in age-structure and age-specific prevalence and frequency rates, producing six sets of standardized convicted offending rates (one each for prevalence, frequency and age-structure for each comparison year). Decomposition separates out the contributions of the different factors used in the standardization process (that is, age-structure, prevalence and

frequency). This expresses the overall difference in the standardized rates between populations as the sum of different contributions of the different factors used in the standardization. Decomposition calculates how much of the observed difference in overall convicted offending rates between comparison years is due to prevalence, frequency and age-structure respectively.

Importantly, this analysis is not causal as the different effects identified by standardization and decomposition may themselves be the products of one (or more) variables not included in the standardization and decomposition analysis[103] (Das Gupta 1993:4). Rather, standardization calculates what the convicted offending rate in the two comparison years would have been, *ceteris paribus*, if these years had the same age-structure, prevalence and frequency as the baseline. Decomposition shows how much of this difference is attributable, *ceteris paribus*, to differences in age-structure, prevalence and frequency.

Implementation

Standardization and decomposition are used to calculate the overall contributions of age-structure, prevalence and frequency to change in the aggregate convicted offending rate between 1989 and 2011. To calculate standardized rates across age-structure, prevalence and frequency, equations described in Das Gupta (1993, eqs.3.12-3.17) are used to apply standardization and decomposition for three vector components, with the three vectors being the age-specific prevalence, frequency and age-structure. For a three-factor decomposition, we can describe the convicted offending rate in a particular year as

1. $R = \mathrm{F}(\bar{\alpha}, \bar{\beta}, \bar{\gamma})$.

where R is the convicted offending rate in the chosen year. This is expressed as a function of three vectors $\bar{\alpha}$, $\bar{\beta}$ and $\bar{\gamma}$: the age-specific proportion of the total population, age-specific prevalence and age-specific frequency respectively. It is worth noting that this equation is is equivalent to

103 This is similar to omitted variable bias.

2. $R = \sum_i \alpha_i, \beta_i, \gamma_i$

Where α_i is the age-specific proportion of the total population, β_i, is the age-specific prevalence rate and γ_i is the age-specific frequency rate. Calculations used to standardize and decompose convicted offending rates will therefore give both the overall contributions of these three factors as well as their age-specific contributions.

With the vector notation we can describe the convicted offending rate in the first comparison year (1) as

3. $R1 = F(\overline{A}, \overline{B}, \overline{C})$

and the convicted offending rate in the second comparison year (2) as

4. $R2 = F(\overline{a}, \overline{b}, \overline{c})$.

From equations 3.12-3.17 in Das Gupta (1993) we see that:

the *βγ*-standardized rate (that is, the rate standardized by prevalence and frequency) in year 1 is *Q(A)*, and in year 2 is *Q(a)*;
the *αγ*-standardized rate (the rate standardized by age-structure and frequency) in year 1 is *Q(B)*, and in year 2 is *Q(b)*;
the *αβ*-standardized rate (the rate standardized by age-structure and prevalence) in year 1 is *Q(C)*, and in year 2 is *Q(c)*.

Consequently we can calculate the effect of age-structure (the α-effect) by calculating Q(A)-Q(a), the prevalence effect (β-effect) by Q(B)-Q(b) and the frequency effect (γ-effect) by calculating Q(C)-Q(c), where[104]

5. $Q(A) = \frac{F(\overline{A},\overline{b},\overline{c}) + F(\overline{A},\overline{B},\overline{C})}{3} + \frac{F(\overline{A},\overline{b},\overline{C}) + F(\overline{A},\overline{B},\overline{c})}{6}$,

104 In these equations the denominators (three and six) are determined by the number of factors (i.e. three) used in the decomposition (Das Gupta 1993).

6. $Q(B) = \frac{F(\bar{a},\overline{B},\bar{c})+F(\overline{A},\overline{B},\overline{C})}{3} + \frac{F(\bar{a},\overline{B},\overline{C})+F(\overline{A},\overline{B},\bar{c})}{6}$,

7. $Q(C) = \frac{F(\bar{a},\bar{b},\overline{C})+F(\overline{A},\overline{B},\overline{C})}{3} + \frac{F(\bar{a},\overline{B},\overline{C})+F(\overline{A},\bar{b},\overline{C})}{6}$

and

8. $Q(a) = \frac{F(\bar{a},\bar{b},\bar{c})+F(\bar{a},\overline{B},\overline{C})}{3} + \frac{F(\bar{a},\bar{b},\overline{C})+F(\bar{a},\overline{B},\bar{c})}{6}$,

9. $Q(b) = \frac{F(\bar{a},\bar{b},\bar{c})+F(\overline{A},\bar{b},\overline{C})}{3} + \frac{F(\bar{a},\bar{b},\overline{C})+F(\overline{A},\bar{b},\bar{c})}{6}$,

10. $Q(c) = \frac{F(\bar{a},\bar{b},\bar{c})+F(\overline{A},\overline{B},\bar{c})}{3} + \frac{F(\bar{a},\overline{B},\bar{c})+F(\overline{A},\bar{b},\bar{c})}{6}$

For example, to calculate the effect of change in age structure between 1989 and 2011 on the overall convictions rate, first requires calculating the prevalence and frequency standardized rate for 1989 ($\beta\gamma$-standardized rate, $Q(A)$) for 1989. To this, the 1989 age-structure (that is, the proportion of the population made up by each year of age) is multiplied by the age-specific 2011 prevalence rates and 2011 frequency rates. This figure is then added to the product of the 1989 age-structure, 1989 prevalence and 1989 frequency, all divided by three. This is the figure represented by the first part of equation 5;

$$\frac{F(\overline{A},\bar{b},\bar{c})+F(\overline{A},\overline{B},\overline{C})}{3} .$$

Then, the 1989 age-structure is multiplied by the 2011 prevalence and 1989 frequency, and then added to the 1989 age-structure multiplied by the 1989 prevalence and 2011 frequency, all divided by six. This is the figure represented by the second part of equation 5;

$$\frac{F(\overline{A},\bar{b},\overline{C})+F(\overline{A},\overline{B},\bar{c})}{6} .$$

Together, these two equations produce the overall convictions rate for 1989 standardized by the prevalence and frequency rates for 1989 and 2011 ($Q(A)$), with

the age-structure for 1989 held constant across these two equations. Following the same procedure but holding constant 2011 overall conviction rates produces the figure *Q(a)*. The difference between *Q(A)* and *Q(a)* provides the effect of changes in age-structure on overall conviction rates between 1989 and 2011.

Results of standardization and decomposition can then be verified by checking that the difference in the convicted offending rates in the two comparison years is equal to the sum of the age, prevalence and frequency effects. Put another way, results should indicate that $R2\text{-}R1 = \overline{\alpha}$-effect+ $\overline{\beta}$-effect+ $\overline{\gamma}$-effect. Results of standardization and decomposition will first be presented to show the overall contributions of prevalence, frequency and age-structure to aggregate convicted offending rates. Following this age-specific contributions will be presented visually to show where in the age-distribution change has occurred. Standardization and decomposition are calculated for men and women separately, and their results compared to analyse potential differences in the impact of these three factors across sex.

One feature of standardization and decomposition as calculated using these equations is that results represent averages across the two years being compared (Das Gupta 1993). This means that calculating standardization and decomposition for the start and end of the period covered by SOI will only give average effects of prevalence, frequency and age-structure, and will not be able to account for non-linearity in these trends. To account for non-linearity in these trends standardization and decomposition are repeated for different periods identified in the data using shaded contour plots (see Chapter Seven). This also helps to hedge against potential ahistoricism (LaFree 1999) – assuming consistent effects over time – by shifting focus away from overall effects of prevalence, frequency and age-structure to examining the relationship between prevalence, frequency and population in different periods. Comparing results between 1989 and 2011 and between different periods within the SOI can demonstrate whether the effects of age-structure, prevalence and frequency have been consistent over time. Even with this approach, it should be noted that the results are sensitive to the choice of years selected. However, informing the selection of years with results from data visualization can help to eliminate potential bias from arbitrary selection of comparison years.

Rationale

Standardization and decomposition provide the most suitable method to achieve the aim of understanding the relative contributions of prevalence, frequency and age-structure to change in convicted offending rates. The primary alternative to standardization and decomposition approaches when assessing the impact of age-structure on convicted offending rates are regression based approaches (Marvell and Moody 1991). A regression approach to exploring the relative effects of prevalence, frequency and age-structure would involve predicting variation in the convicted offending rates using a number of independent variables which included measures of age-structure, prevalence, frequency and time. Das Gupta (1993) contends that this regression modelling approach, explaining the variance in the dependent variable (in this case, the overall conviction rate) using predictor variables (age-structure, prevalence and frequency) is not equivalent to the question addressed by standardization and decomposition; the two methods address different problems. Standardization and decomposition calculate the different contributions of age-structure, prevalence and frequency have to declines in convicted offending between selected comparison years (Das Gupta 1994). Thus, standardization and decomposition seek to explain the change over time which is already known to have occurred. A regression approach to this problem would seek to explain the total variance in convicted offending rates, assessing how much time, in addition to age-structure, prevalence, frequency and other factors, can predict this variation.

In addition to this harmony of aims between standardization and decomposition and this thesis there are also methodological benefits to the standardization and decomposition approach as implemented here. Regression approaches to estimating the impact of age-structure on total convicted offending rates typically require taking one part of the age structure as an independent variable (Levitt 1999:585), as including multiple age groups within the regression model can lead to collinearity and thus imprecise model estimates (Marvel and Moody 1991). As a result, it is difficult to gain age-specific estimates of the contribution of change in age-structure, prevalence and frequency, to on overall conviction rates, unlike standardization and decomposition. These age-specific estimates are crucial to allowing comparisons across age groups in the effects of these three factors, which can help to assess whether results observed by Berg et al. (2016) can be generalized beyond the

demographic group they studied (men aged 17-18). In sum, whilst Marvell and Moody (1991) show that it is possible to examine the effects of age structure on conviction rates within a regression framework, the standardization and decomposition approach is favoured here.

The method discussed here also has two important benefits compared to the decomposition approaches previously adopted by Levitt (1999) and Rosevear (2010) to assess the impact of age-structure on the crime drop. First, the equations specified by Das Gupta (1993) provide standardized populations across comparison years, rather than directly multiplying the values of age-structure from one year with the crime-rate in the second year. In contrast, Levitt (1999) and Rosevear (2010) apply the observed age-structure from the start of his reference periods to the arrest rate at the end of the reference period. With this approach the estimates calculated vary depending upon which year is used as a reference year, and so these estimates are not considered robust (Das Gupta 1993:1). The formulae described above correct for this error (Das Gupta 1993), and provide estimates of the effect of change across age-structure, prevalence and frequency that do not differ based on the order in which the years being compared are entered into the equations. Second, using the more general form of decomposition as outlined by Das Gupta (1993) allows the consideration of the effects of prevalence and frequency separately, rather than combining their effects into the total impact of the convicted offending rate. In Levitt's (1999) analysis, the effect of prevalence and frequency are combined into a single arrest rate. Whilst this may be as much a limitation of the data available in previous analyses as of method, employing Das Gupta's (1993) methods allow for the effect of all three components to be calculated simultaneously and potentially different contributions of prevalence and frequency to be identified.

5.4 Latent Class Analysis

LCA is a statistical technique which simplifies response patterns in observed data. As used here LCA acts as a form of data reduction (Skardhamar 2010a:314), providing a classification which divides the population of those convicted into groups with the number of groups identified statistically. LCA is premised on the idea that a population is likely to contain a number of different sub-populations or sub-groups. In the context of convictions data, and of particular interest here, these groups are

likely to comprise low-frequency and high-frequency offenders (see discussion in Chapter Two). In LCA, membership of these different groups is unobserved but can be estimated from the data which is observed (Vermunt and Magidson 2002). It is not known for certain which conviction group a person belongs to, but this can be estimated from their patterns of conviction. Put another way, with the LCA approach variation in observed outcomes – in this case, convictions – is attributable to membership of an underlying latent class. LCA therefore helps to reduce the complexity in patterns of data across a number of observed variables, relating them to a single underlying categorical variable. Figure 5.2 illustrates the relationship between the latent class variable (*c*) and the observed items used to estimate the latent variable (*u1-u4*).

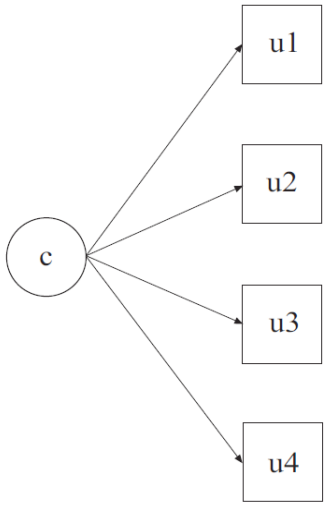

Figure 5.2 Illustration of Latent Class Analysis. From Muthén and Muthén (1998-2012:164)

Determining the number of classes

LCA does not produce a single, 'best' solution. Solutions can be estimated for any number (*k*) of latent classes. Determining the most appropriate solution first requires assessing whether the results of a particular model represent a global maximum for that solution. To ensure that LCA results are reliable they must be identified by multiple sets of starting values. This requirement comes from the iterative way in which LCA solutions are calculated (see Muthén 2001) in Mplus 6.1, the program used for this analysis. It is advised that estimates should not be considered to represent the best possible solution (or 'global maximum') unless they have been reached by multiple random starting values. In this thesis, all results

presented are from models identified by multiple random starts, and are therefore considered global maxima. Where latent class solutions have not reached a global maximum, results are listed as "no global maximum identified".

To identify the best fitting models from a selection of models with different numbers of classes that have all identified global maxima, Information Criterion Likelihood tests (ICs) provide an assessment of relative model fit. The general aim of ICs is to help guide the selection of an appropriate statistical model to represent a given dataset. This assessment is made based on the log-likelihood of a fitted model, with the log-likelihood representing the likelihood of the observed data being produced by the particular LCA solution specified.

Typically the model with the lowest IC score is considered the best fit to the observed data. ICs can also be interpreted in the same way as a scree-plot (Norris 2009:111); if the absolute difference in the IC between the LCA solution with the lowest IC (but a larger number of classes) and models with fewer classes (but a higher IC) is small, the smaller number of classes can be considered to describe the major heterogeneity in the data. This solution may be preferable as opposed to one with a lower IC score but in which the additional classes have little substantive meaning (Norris 2009:111). What exactly constitutes a small gap is to be determined by the researcher. As an example, Norris (2009:152) prefers a five-class solution with a BIC that is 0.46% higher than a six-class solution on the grounds that the additional classes produced by the six class solution provide little explanatory value[105].

This thesis uses a combination of the Akaike Information Criterion (AIC; Akaike, 1987), the Bayesian Information Criterion (BIC; Schwartz, 1978) and the Adjusted Bayesian Information Criterion (ABIC; Sclove, 1987). These different ICs use different formulae to compensate for differing numbers of parameters and sample sizes across models in describing the fit of different models. Simulation studies such as (Nylund et al. 2007) suggest that BIC is the best performing IC. However, the Nylund et al. (2007) simulation focused on categorical and continuous data whilst the current analysis uses count data. In addition, the sample sizes used in the Nylund et al. (2007) simulation are much smaller (a maximum of 1,000) than those

105 Calculations are authors own based on table 5.6 in Norris (2009:145).

used in this study, which may make their results less applicable here. Moreover, BIC and ABIC improved their performance as sample size increased in the Nylund et al. (2007) simulation, and whilst AIC was less consistent, it too showed some improvement with sample size for complex LCA's with continuous response variables in the Nylund et al. (2007:558) tests. As such, AIC, BIC and ABIC are used together to identify the optimal LCA solution.

As well as ICs, the Vuong–Lo–Mendell–Rubin Likelihood Ratio Test (VLMR; see Lo, Mendell and Rubin 2001) and the bootstrapped likelihood ratio test (BLRT, McLachlan and Peel 2000) have been proposed as formal ways to assess the number of classes in LCA. These likelihood-ratio tests perform significance testing on the difference between two nested models by comparing the likelihood ratio for a model with *k* and *k-1* classes. Whilst these tests performed well in the Nylund et al. (2007) simulations, there are many real-world instances where BLRT and VLMR disagree with each other and where BLRT does not perform well (Muthén 2009). In such cases it is preferable to use a combination of BIC and substantive interpretation (Muthén 2009). When using BLRT Mplus gave a warning that the bootstrap draws did not converge, and so results were not considered trustworthy[106]. As a result AIC, BIC, ABIC and VLMR are preferred as criteria for deciding the most suitable number of classes in the LCA, in combination with substantive interpretation.

Determining the character of classes

Substantive interpretation involves both assessing the character of classes produced by different LCA solutions and also the size of these classes. Determining the character of classes is achieved primarily by plotting item thresholds for different solutions (see Norris 2009), which in this study shows the mean number of convictions for different types of crime for different classes. Plotting item thresholds presents an illustration of the properties of the different classes which can help determine the additional value models with additional classes. For example, a four class solution and a three class solution may produce latent classes with very similar profiles, with the additional class produced by the four class solution being similar to one of the other classes produced by that model (for example, a slightly higher or lower number of convictions of a particular type). As discussed above, if the four

106 This error was received even after increasing the number of draws to 2000 from the default of five.

class solution is only preferred by AIC, BIC and ABIC by a small amount, it may be preferable to adopt the solution with fewer classes but a higher IC on the grounds of parsimony given that the extra class produced by the more complex solution provides little substantive value.

Interpretation of LCA classes based on the profile of different classes can be supplemented by assessing results which show the membership of different classes. In particular, cross-tabulating most-likely class membership across latent class solutions can give a further indication of whether different solutions are creating meaningful groups when combined with information about the class profiles (Norris 2009). For example, when comparing solutions with *k+1* and *k* classes, if one large class is split into two groups with different profiles these new classes can be seen as substantively important. If an additional class with a distinctive profile is drawn from across multiple previous classes this can also be considered an important addition. In contrast, if additional classes are formed by splitting a single existing group into two groups with similar profiles, this may add little to the analysis.

In addition to the model results which show the profiles of different latent classes, there are inevitable theoretical issues when describing people as being members of different offending or conviction classes (Sampson and Laub 2005, Skardhamar 2009). In the context of this thesis, groups produced by LCA are best understood as 'heuristic devices' (Sampson and Laub 2005:41) acting as a rough summary of the convictions patterns in the SOI. Latent classes produced represent one description of the convictions patterns observed in the data and any statistical model of complex and messy social reality is only one of a number of potential mathematical summaries (Bradley and Schaefer, 1998). Again, the identification of different latent classes should not be understood as representing different types of *people* with different underlying causes of their offending. The current analysis does not aim to make such an assessment, and the data in the SOI do not contain sufficient additional explanatory variables to allow analysis of the factors which can predict group membership. Rather, latent classes provide a way to succinctly describe the distribution of convicted offending amongst those convicted in Scotland, without implying particular causes of offending for people classified into different groups.

Classification Uncertainty

In Mplus, LCA assigns a probability of being a member of each latent class to every case included in the analysis. For example, a four class solution would produce five variables: probability of being a member of class one, then classes two, three and four and finally a variable listing the class with the highest probability membership. When analysing the dataset as a whole this allows each case to contribute to different latent classes, accounting for potential error when assigning people to classes. For this analysis, these class membership probabilities are used to weight the contribution of different cases to different latent classes as their membership over time is analysed.

For the model as a whole the uncertainty of class membership is described by the entropy statistic. Rather than being a measure of model fit, entropy is based on the distinctness of the classes produced by the LCA (Vermunt and Magidson 2002). Entropy values closer to one represent better classification of individuals into latent classes, and an entropy score of one would indicate that cases were perfectly classified into latent classes and consequently that there was zero error when allocating cases into their most likely class (Clark and Muthén 2009:27). Entropy can give an indication of the robustness of the most-likely class variable as an indicator of class membership. Clark and Muthén (2009) suggest that with an entropy score of 0.8 or higher most-likely class membership can provide a reasonable indication of class membership.

Implementation

LCA for this analysis was conducted using Mplus 6.1. Once an optimal solution of classes was identified (see Chapter Eight) class membership probabilities were exported from Mplus and then recombined with SOI data in order to chart the number of men and women of different age groups assigned to different classes over time. Class membership probabilities were used to weight contributions to different groups. This weighting was conducted by summing the probabilities for each latent class across each age band for each each five-year window. Running LCA on SOI required arranging the data in a format suitable for analysis, as well as constructing the LCA to account for the particular nature of SOI data. Four decisions are of particular relevance here: the selection of an age-window for analysis, accounting for

the over-dispersion in the SOI conviction data, including time in prison as an offset and incorporating different types of crime in the latent class model. This section also discusses how change over time in membership of the latent classes produced by LCA are visualised.

Selecting time periods for analysis

Before running LCA on SOI data, the data was divided into equal time periods. This allows a consistent (maximum) exposure time for different people, providing a consistent comparison in rates of conviction within a given time frame. One consequence of this approach is that the LCA classifies age-bands, not people (Francis et al. 2004b). When deciding on the size of age-window, Francis et al. suggest that the size of the window "is to some extent arbitrary" and that "the primary consideration is to obtain an interval of sufficient length to gain a picture of the individual's offending career in that portion of the life course" (2004b:55). Based on these criteria, Francis et al. analysed an LCA model using convictions data split into five-year age windows. Their analysis was conducted on the Offenders Index for England and Wales, a comparable dataset to SOI, which makes this a natural point of reference for this study. Consequently, the same procedure is adopted here, with conviction data in the SOI being divided into five year age bands for those with convictions between the ages of 16 and 40. Descriptive statistics for the prevalence of convictions over age suggested that for much of the period covered by the SOI prevalence of conviction increased between the ages of 16 and 20 and declined thereafter (see Chapter Six). Splitting the data into five year age bands thus allows the inclusion of the peak of the age-crime curve into a single age-band. In addition, there is reason to believe that a person without a conviction for at least five years – as is the case using five year age-bands – has a similar probability of offending as someone with no prior convictions[107] (Kurlychek et al., 2006). This provides support for understanding a period of five years without a conviction as a suitable time period to reflect desistance, and supports the division of convictions histories into periods of five years. Analysis was capped at age 40 due to the low rates of convicted offending for those older than this age as (see Chapter Seven). When analysing

107 Whilst Kurlychek et al. (2006:499) did find statistically significant differences between the probability of reoffending for those five years removed since their last conviction and those with no convictions at any point, the chance of conviction for these two groups was substantively similar and small in absolute terms.

change over time, these five-year age bands are referred to using the year at the start of the age band.

It is worth reinforcing that the results produced from this type of analysis will vary based on the time periods selected, and that LCA results are only one potential summary of the convictions patterns within SOI. As such, results should not be over-interpreted as representing the 'true' distribution of convicted offending classes over time in Scotland.

Taking each five-year age band covered by this age range provided 500,360[108] age bands during which a person was served a conviction. Age bands in which a person did not receive a conviction were removed from the model. This allows LCA to classify convicted people without skewing results by including those who were not convicted within a given time period. Running LCA on the whole SOI in a single model provides a consistent definition of the latent classes over time against which class membership in different periods and cohorts can be compared (Soothill et al. 2008:79). This allows the examination of change over time in membership of convicted offending classes using a consistent reference point. Latent classes were also estimated on each of the five-year age windows (16-20, 21-25 and so on, see below) separately as a form of sensitivity analysis in order to assess whether the overall LCA produced qualitatively similar classes to the LCA estimated on different age bands. Fit statistics and class profiles for each age-band, as well as for the model including all data adopted for final analysis, are included in Figures 8.3 and 8.4.

Count data and over-dispersion

Convicted offending data in SOI is count data, meaning that it is non-negative and only takes discrete values. In addition, descriptive statistics (see Appendix Seven) showed that conviction data in SOI, as is common with offending data, was over-dispersed (i.e. had a variance is greater than its mean). This violates one of the assumptions of the Poisson distribution, which is often used to model count data (Hilbe 2014), that the mean and the variance of the distribution can be described by a single parameter. To account for this over-dispersion a Negative Binomial model

108 This figure also excludes those for whom sex was missing or contained multiple values (see Section 4.4).

was used to estimate LCA on SOI. Negative Binomial models add a dispersion term to standard Poisson model to account for the additional variance (Hilbe 2014) in over-dispersed data.

Practically, the use of a Negative Binomial distribution to identify latent classes is likely to reduce the number of classes required to capture the variation in the data. This is because the dispersion terms allows a greater amount of variation to be described by the Negative Binomial model as opposed to a Poisson distribution. Conversely, the skew of the count data may require more classes for the LCA to adequately capture the variation in the data (Muthén 2016). These two observations highlight that LCA results should not be considered to represent the 'true' nature of the underlying data, and places additional emphasis on carefully interpreting the properties of the groups identified to assess whether additional classes are substantively meaningful and distinct from other classes.

Time in prison

As discussed in Chapter Two, it is important to account for time in prison when estimating the results of LCA using these types of conviction data. Ignoring time in prison may lead to bias in the estimation of different latent classes of convicted offending for people given custodial sentences who have a restricted capacity to offend and be convicted during a given period (Eggleston et al. 2004). As such, the time in prison variable included in SOI is incorporated into the LCA model as an offset. Including time in prison as an offset accounts for uneven exposure time between age-bands (Hilbe 2014:63)[109].

The estimate for the amount of time spent in prison is that used by Scottish Government to estimate the amount of time a person will spend in prison to calculate reconvictions statistics[110], which is included in SOI. Where a person had multiple overlapping prison sentences listed in SOI the latest release date listed was used as the estimated release

109 It could be argued that the focus of this thesis on describing observed patterns of convictions (see Chapter Four) makes the use of the offset redundant when calculating the LCA. Consequently latent classes were estimated with and without the time in prison offset. Analysis of polarisation based on LCA results which did not include the offset were conducted as a form of sensitivity analysis (Eggleston et al. 2004:24). These results were substantively similar to those produced using the offset, and are presented in Appendix Eight.

110 These calculations are based on "the length of sentence imposed, assumptions about time spent on remand and release on parole, and information about whether the offender had been granted bail" (Scottish Government 2015:42).

date. Coding the time in prison variable in this fashion led to a small number of cases with extreme values (for example, 351 cases had 1826 days in prison – the whole five-year period[111]) and also committed an offence for which they were convicted. Others were listed as being in prison for the entirety of five-year age windows whilst still receiving new convictions. This is logically possible (for example, people can commit offences whilst in prison or be convicted of historical crimes), but this caused an error in model estimation as the model was attempting to estimate a convictions rate with zero exposure time. To allow models to estimate, the time in prison was reduced to 95% of the total listed in the time in prison variable. To assess the impact of adjusting the time in prison variable in this way, multiple LCA models were estimated using different caps (including no cap) as a form of sensitivity analysis (Connelly et al. 2016). Class membership probabilities and class proportions did not vary substantially between models (see Appendix Eight) suggesting that the choice of cap did not overly influence the LCA results.

The offset was included in the LCA model using the formula:

(1826 – time in prison)/1826

(see Asparouhov, 2009) to represent the proportion days spent out of prison in different five-year age bands.

Crime type

Given the importance of crime type to theories of the crime drop (see Chapter Two, and also Chapter Seven) it is important to include potential differences across types of crime in the LCA model. To this end, LCA was modelled using six of the eight crime types listed by Scottish Government (see Chapter Four) as observed outcomes. Sexual offences and prostitution were collapsed into other crimes and offences due to small numbers of people convicted for these crime types. Separating different types of crime in the LCA model allows the estimation of which (if any) types of crime are frequently committed together. For example, it may be that there is a group of people with large numbers of convictions for a particular crime type but with few convictions for other crime types. These differences can be seen when

111 For some the five years would contain 1827 days due to the presence of two leap years. However, for the sake of consistency all cases were handled with the same offset using 1826 days.

estimating a LCA which includes different crime types as observed variables. In particular, given the importance of crimes of dishonesty to the securitization hypothesis (see Chapter Three) this model specification allows LCA to identify these people, and – if identified – explore the membership of this group over time.

Visualising trends over time

After the classifying people into different convictions classes, the proportion of men and women grouped into these classes in different years are analysed visually to understand changes in class membership over time. When analysing trends in the proportion of membership of different latent classes trends are smoothed using a *loess* smoother (Cleveland and Loader, 1996). This is implemented via the stat_smooth() command in the R package ggplot2() (Wickham 2009). Smoothing the trend helps to reduce the impact of variability which can occur due to the small numbers involved. Smoothing with a *loess* function is desirable rather than fitting a linear model as it can account for non-linearity and complex trends in data (Jacoby 2000) which do not require prior specification. This strategy is therefore in-keeping with the descriptive and exploratory aims of this analysis.

Rationale

The results of the LCA analysis are used to explore whether the distribution of convictions has become more polarised, and so to answer Research Question Three. Whilst the focus of their study was not explicitly in examining polarisation, this can be considered a similar approach to that used by Soothill et al. (2008) as discussed in Chapter Two. Using a statistical clustering approach has a number of advantages over using an *ex ante* cut point to determine between high- and low-frequency offenders. First, assuming that distinct groups exist *ex ante* does not allow testing for their presence (Nagin 2016). With LCA the number and nature of groups identified can be assessed with help from statistical criteria. Moreover, the choice of classification can have a substantial impact on the assignment of people into different groups (Hagell and Newburn 1994). Determining groups statistically helps to mitigate against arbitrariness in determining group formation and membership. Second, the LCA approach allows the profile of groups to be estimated from the data incorporating factors such as time spent in prison and counts of different types of crime in the classification. It is not clear how such factors would be including in an

ex ante classification.

LCA also has advantages compared to other potential statistical clustering methods. In contrast to other clustering methods such as cluster analysis, LCA is underpinned by a statistical model that provides guidance when determining the appropriate number of classes. Whilst determining the number of classes also requires substantive interpretation (as discussed above), the guidance provided by these fit statistics is a benefit of LCA (Vermunt and Magidson 2002).

5.5 Weighted cross-tabulations

The LCA model described above also forms the basis of the analysis of pathways of offending. Transitions between convictions classifications at different time points are cross-tabulated over consecutive age-bands, described here as 'transition points' (see Chapter Four). Cross-tabulating this class membership information provides a descriptive understanding of the patterns of transition in the data (Nylund 2007).

Table 5.1 Illustration of calculating weighted transitions between age-bands

Class membership at age-band one	Class membership at age-band two			
	k1	k2	k3	k4
k1	*k11*	*k12*	*k13*	*k14*
k2	*k21*	*k22*	*k23*	*k24*
k3	*k31*	*k32*	*k33*	*k34*
k4	*k41*	*k42*	*k43*	*k44*

To calculate the proportion of people making different transitions between classes, each person's latent class membership probabilities are extracted from the LCA for consecutive age-bands. These probabilities are multiplied to provide a probability of being in each class at each time point (see Table 5.1). Weighting the cross-tabulation in this way accounts for the measurement error introduced by using most-likely class as an indicator of class membership[112]. For those with no convictions recorded in a particular age-band the probability of being a member of the no convictions class was set to one and the probability of belonging to any of the classes identified

112 Clark and Muthen (2009) caution against the use of most-likely class as an indicator of class membership when the entropy of a LCA is lower than 0.8. As the entropy of the k=3 model is 0.721 (Chapter Eight) this approach is not advisable in this study.

by the latent class analysis was set to zero[113]. Weighting the transition analysis in this way has the benefit of accounting for the classification uncertainty produced by the LCA whilst also allowing for the simple comparison of results across different transition points over time. By plotting the proportion of people who make different transitions in each year at different transition points, trends in pathways of conviction can be analysed. As discussed in Chapter Four, comparing trends in transition for people of different ages (that is, at different transition points) in the same year can help to ascertain whether change in these trends are most likely to be age, period or cohort effects.

An additional benefit of this approach of estimating patterns of criminal careers through discrete age-bands is that it helps to avoid the right-hand censoring problem which can cause problems when modelling convictions patterns over time, and particularly identifying desistance (see Laub and Sampson 2001:9). It is problematic to classify a person as a desister (or as belonging to a group of desisters) based on available data, as there is always a possibility of that person offending again in the future after the period of the data is gathered (Nagin 2016). Classifying transitions rather than people reduces this right-censoring as the classification relates only to age-periods, rather than people themselves as people can contribute age periods to different latent classes (see Francis et al. 2004b). Consequently, people who make desistance transitions, as measured by not having a conviction within a five-year period, may still be subsequently convicted[114]. In addition, the selection of five-year windows should reduce random variability in convicted offending which may be caused by the selection of shorter time intervals (Greenberg 1991:22, see also Section 5.4). It is still key to note that, as with any statistical model, no assumptions are made about patterns of conviction outside the range of data covered by SOI (Nagin 2016).

113 Transitions between No conviction and No conviction classes are not included in this analysis. One way consistent non-offending pathways could have been analysed would have been to use estimates of total population size to identify the number of men and women of different ages who were not convicted in a given period (see Bartolucci et al. 2007). However, as the focus of the analysis is describing pathways into and out of convicted offending, the number of people who consistently do not offend is not relevant to answering this research question.

114 It should also be remembered that this use of the term desistance is not the same as the conception of the term relating to the process of change leading to the cessation of offending (see Section 2.4).

Implementation

Weighted transitions between age bands were calculated based on the class membership probabilities exported from the LCA described in Section 5.4. Estimates of the numbers of people making different transitions were converted into cross-tabs, with this process being conducted for men and women separately, first for all age groups covering all years, second then split by age band for all years, and finally split by both age-band and year of transition.

Rationale

The cross-tabulation approach utilized in this analysis is preferred to a model-based extension of LCA such as Latent Transition Analysis (LTA) in order to analyse change in pathways of conviction over time, and in so doing to answer Research Question Four. In LTA latent classes are estimated as in LCA, based on a set of observed variables, except that the observed variables used to estimate the classes relate to two different time points. In LTA latent classes are estimated for each time point, with class membership at the second time point regressed on latent class membership at the first time point to estimate the probability of transitioning between classes (Nylund 2007).

The cross-tabulation approach has a two main benefits when compared with LTA. First, the cross-tabulation method discussed above is much simpler than the LTA approach. Estimating an LTA with very uneven class sizes (see Chapter Eight) produces a sparse transition matrix meaning that many of the potential transitions cannot be populated, and with the large volume of data in the SOI becomes very computationally intensive. These are not necessarily barriers to using LTA *per se*, but do complicate attempts to assess the impact of change over time on transitions. This would be done by adding a covariate into the model for period[115]. Covariates for gender and interaction terms between period and gender would also be required to control for differences in the gender composition of different years, and assess whether men and women had different trends over time. The overall effect is to produce a complicated model, adding to the computational issues arising from the size of SOI. In contrast, the simplicity of cross-tabulating transitions over time

115 To assess whether change over time was linear, additional terms would have to be added to the model.

allows annual change in conviction pathways to be assessed, and potential non-linear patterns to be observed with minimal difficulty.

Second, the cross-tabulation method described here is more in line with the descriptive aims of this thesis than the model-based LTA approach. With a model-based approach, the investigation of trends over time would be conducted via the incorporation of the period term in the regression of class membership at time point two on class membership at time point one. Results of a period covariate in an LTA model would in effect give an answer to the question of *whether* patterns of transition between latent classes changed over time. In contrast, the cross-tabulation approach answers the question of *how* patterns of transition have changed over time in SOI. As the focus of this analysis is to understand how pathways of conviction have changed in SOI, the cross-tabulation method provides a more relevant solution. Again, this rests on the understanding of SOI as a census of conviction. The barriers to generalization of results from SOI are more those of interpretation, and substantive questions about the functioning of the justice system in Scotland as compared to other countries, as they are of statistical significance. As such a descriptive account of patterns of transition are more important than an assessment of statistical significance of trends over time, especially given the difficulty in constructing a viable LTA model.

The method outlined here of weighting class membership by class membership probability is preferred to the adoption of most-likely class as an indicator of class membership as used by Francis et al. (2004b). Incorporating the uncertainty of class membership assignment into the analysis of transition removes the measurement error that is introduced into LTA by using most-likely class as a class indicator (Clark and Muthén 2009). Such measurement error could produce unreliable results, especially if the classes produced by LCA are not distinct (Clarke and Muthén 2009).

5.6 Conclusions

This chapter has presented the methods to be used in this analysis, how these methods are to be applied in this thesis and the reasons for the selection of these methods over alternative approaches. This chapter has argued that data

visualisation, in the form of shaded contour plots, standardization and decomposition, latent class analysis and weighted-crosstabulation present the most suitable methods to answer the four Research Questions as outlined in Chapter Four.

Original contribution

The selection of methods used in this analysis also form part of the original contribution of this thesis. Shaded contour plots have not previously been used to examine change over time in the age-crime curve. This novel method allows the examination of annual change in the age-crime curve which is difficult to appropriately visualize using standard methods. Shaded contour plots also allow the visual examination of age-period-cohort effects. As discussed in Chapter Four, analysis of APC effects is of crucial importance to this analysis, as well as fulfilling Sampson's (2015) call for greater understanding how crime rates have changed for different cohorts over the course of the crime drop. Similarly, whilst two-factor decomposition has been employed previously in criminology to assess the impact of age-structure and crime (Levitt 1999, Rosevear 2010) and also to understand differences in the composition of the prison population in the USA (Vogel and Porter 2015) three-factor decomposition has not previously been used to examine these issues. The use of this form of decomposition demonstrates the value of using demographic methods to exploring criminological questions. Das Gupta's (1993) framework which generalizes the approaches used by Levitt (1999), Rosevear (2010) and Vogel and Porter (2015) to three factors illustrates the potential for this method to examine more complex questions than those previously addressed in the criminological literature. Whilst latent class methods have been popular in the study of criminal careers, this thesis represents their first application to assess change in polarisation and pathways of conviction over the crime drop, expanding on the framework presented by Francis et al. (2004b). In these three ways the methods adopted for this thesis present a methodological advance on the methods previously used to explore change in criminal careers over time.

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This chapter and the preceding chapter have set out how this thesis intends to

explore changing patterns of criminal careers over the course of the crime drop. which stem from the review of the literature presented in Chapters Two and Three. Having outlined the methods used to answer the research questions which inform this thesis, the following four chapters present the results of the analysis conducted using these methods.

Chapter 6. The Age-Crime Curve and the Crime Drop in Scotland

6.1 Introduction

The aim of this chapter is to describe change in the age-crime curve over the period of the crime drop and so to answer the research question 'How has the aggregate age-crime curve changed over the course of the crime drop in Scotland for men and women and across crime type?' This question is answered across three sections. First the chapter compares age-crime curves from the first and last years in SOI (1989 and 2011) for convictions of all crime types, to examine overall change in the age-distribution of crime over the crime drop. These comparisons are made by plotting age-specific rates of convicted offending, and then analysing change in descriptive statistics of the different distributions. The analysis shows that the crime drop in Scotland reflects a substantial reduction in youth convictions. Second, age-crime curves for different types of crime are compared between 1989 and 2011 using the same methods as described above. This assesses whether different types of crime have shown similar patterns of change across age. The findings show substantial variation both between crime types and in patterns of change between men and women. Finally, the chapter examines annual variation in age-specific prevalence rates for convicted offending to assess how the change described in the first and second sections is manifest differentially over time. This analysis is conducted using shaded contour plots and shows three distinct periods in the data marked by different patterns of conviction. This pattern holds both when examining conviction for all types of crime and when the data are split by crime type.

After these results are presented, the chapter discusses their implications and relates the findings back to previous studies of change in the age-crime curve as discussed in Chapters Two. This chapter raises themes that are also discussed in Chapters Seven, Eight and Nine, relating patterns of change in the age-crime curve to theories of the crime drop. As a full understanding of how change in criminal careers impacts upon our understanding of the crime drop requires considering results from these four chapters together, this aspect of the results from this chapter are not discussed until Chapter Ten.

6.2 Comparison between age-crime curves for all convictions for men and women in 1989 and 2011

Figure 6.1. shows the overall difference in the age-crime curve for men and women in Scotland between 1989 and 2011. Age runs along the x axis and the conviction rate (per 10,000) along the y axis. Figures for men and women are presented on different scales. Figure 6.1 shows that from the start to the end of the period covered by the SOI there are marked differences in patterns of changing convictions across age and between men and women. Both men and women in their mid-twenties and younger have seen major declines in rates of convicted offending, whilst those between their late twenties and mid-forties have seen rates of convicted offending increase.

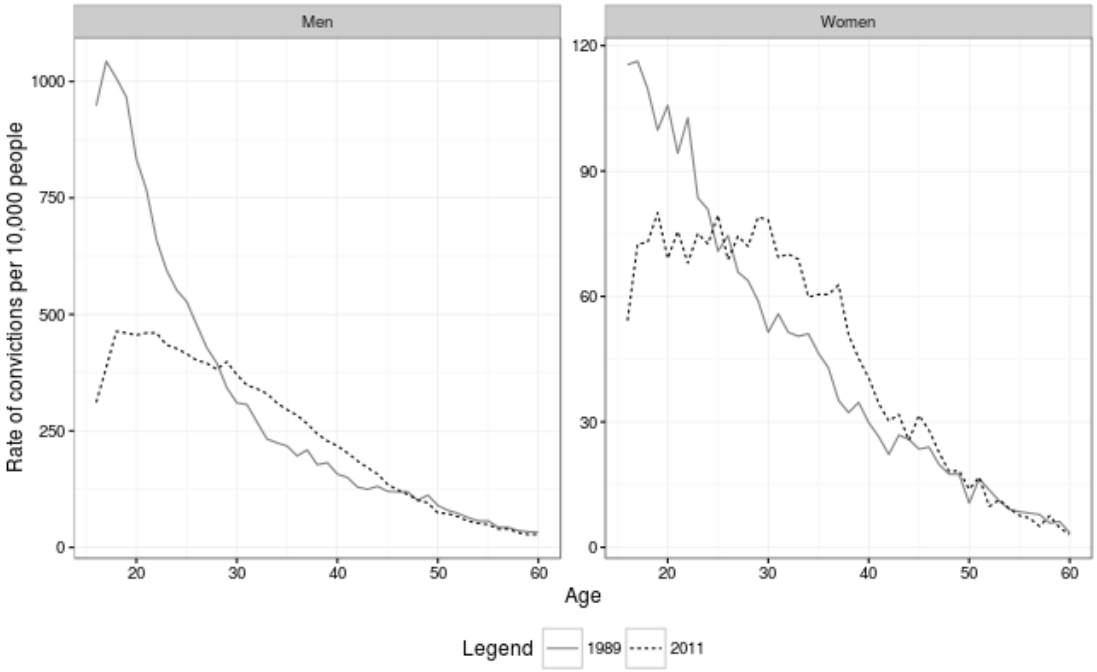

Figure 6.1. Age-crime curves in SOI 1989-2011

That falling conviction rates are due to a decline in convictions served to young people, with older people showing an opposite trend, are key findings that echo through the rest of the analysis presented in this thesis. As such it is worthy to consider in detail, and comparing change in conviction rates for men and women aged 17 and aged 30 illustrates this point. In 1989 the rate of convicted offending for 17 year old men was 1,043 per 10,000 and by 2011 it was 385 per 10,000. By contrast, in 1989 the conviction rate for 30 year old men was 310 per 10,000, and in

2011 it was 374 per 10,000. Put another way, in 1989 the conviction rate for 17 year old men was around two and a half times greater than that of 30 year old men but by 2011 the rates of convicted offending for 17 and 30 year old men were almost identical. For women, the rate of convicted offences was 116 per 10,000 for 17 year-olds in 1989, declining to 73 per 10,000 by 2011. In contrast, for 30 year old women, the convicted offending rate in 1989 was 51 per 10,000 which had risen to 78 per 10,000 by 2011. Again, this shows that, despite starting at very different levels in 1989, by 2011 women at age 17 and age 30 had almost identical conviction rates.

Table 6.1. Comparison of change in rates of convicted offending for men and women aged 17 and 30 in 1989 and 2011

Age	Sex	Year		Relative change (%)
		1989	2011	
17	Men	1043	385	-63
	Women	116	73	-37
30	Men	310	374	+21
	Women	51	78	+53

Source: SOI.

These results show that for men and women there is a disparity in declining rates of convicted offences in Scotland across age, with declines being concentrated amongst those aged 25 and below. However the relative magnitude of these changes are different between sexes; the drop in convicted offending is greater for young men than young women, and the relative increase is greater for older women than older men. This can be seen in Table 6.1, which compares the magnitude of change in rates of convicted offences for men and women aged 17 and 30 between 1989 and 2011. These results highlight that falls in convictions for young people are of a lower magnitude for young women compared to young men, and increases in convictions for people between their late twenties and forties have been relatively greater for women than men.

The result of these divergent trends is that the shape of the age-crime curve for men and women is much more similar in 2011 than it was in 1989. Table 6.2 presents descriptive statistics for age-crime curves for men and women in 1989 and 2011. For both men and women we see increases in the mean and median ages of offending,

Table 6.2. Descriptive Statistics for Age-crime Curves in 1989 and 2011 split by sex				
Measure	Men		Women	
	Year			
	1989	2011	1989	2011
Mean	26.218	30.753	28.016	31.252
Median	23	29	25	30
Mode	17	18	17	19
Skew	1.828	0.725	1.225	0.615
Kurtosis	2.427	-1.074	0.329	-1.331
Rate at peak age	1043.378	463.740	116.267	80.011
Half of peak after	26	39	30	41
25th percentile	19	22	20	23
75th percentile	30	38	34	38
Standard deviation	9.879	10.898	10.257	10.383
Source: SOI. Figures to 3dp. Rates are per 10,000 population.				

but much less change in the modal age of offending. This shows that whilst the (mean) average age of those with convicted offences has increased, the location of the peak of the age-crime curve (mode) has shown much less change. There are also substantial declines in the conviction rate at peak age for men (dropping by just over 65%), and more modest declines for women (declining by just over 31%), combined with increases in the half peak age and declines in skewness and kurtosis. Together these results describe the 'flatter' age-crime curve for both men and women in 2011 than in 1989. This trend is also seen in the increases in the 75th percentile and standard deviation of the distribution which indicate a more dispersed age-crime curve less concentrated around the peak age of conviction. Comparing figures for skew and kurtosis, we can see that there has been more change in kurtosis than skew for both men and women. This reinforces that most of the change in the distribution of age and crime relates to the size of the peak (kurtosis) rather than where in the age distribution the peak is (skew), echoing the findings of increasing mean and median age of conviction but a relatively stable modal age. Consequently the peak of the age-crime curve is much less pronounced for both men and women in 2011 than in 1989. In 1989 the peak of the age-crime curve in the late teens marked a period of distinctively high rates of convicted offending, and, whilst the age at which convicted offending peaks is similar in 2011, rates of conviction in the late teens are very similar to those for people in their twenties.

The finding of a substantial decrease in rates of convicted offences for young people

over the course of the crime drop is consistent with the findings from the USA and elsewhere in Europe (see Chapter Two). More surprising is the presence of increases in convictions for those in their mid-twenties in Figure 6.1, in stark contrast to results from the USA which did not see increases in arrest rates for older adults over the course of the crime drop until their early forties (Farrell et al. 2015, Kim et al. 2015). This analysis using SOI shows an important difference compared to previous analysis using US arrest data, an important original contribution of this thesis.

It is also worth noting that the observation of a decreasingly peaked age-crime curve is the opposite of the increasingly peaked age-crime curve described by Farrington (1986) from the 1930s to the 1980s. Moffitt (1993) explains an increasingly peaked age-crime curve as being due to increasing levels of modernization leading to a greater maturity gap for adolescents, and so a prolonged period of adolescent-limited offending. These results suggest that, rather than explaining a more sharply peaked age-crime curve, it is more important to understand why this trend has been reversed.

6.3 Comparison between age-crime curves for different crime types for men and women in 1989 and 2011

Figures 6.2 and 6.3 build on the results shown in Figure 6.1 by comparing age-crime curves for different crime types for men and women respectively. These crime types are breach of the peace, criminal damage, dishonesty, drugs offences, violence and all other crimes and offences. Each age-crime curve is on its own scale on the y-axis. These results are supplemented by Figure 6.4. which shows a comparison in the percentage change in the prevalence of convicted offending for each age in each year. This analysis shows substantial differences in patterns between age-crime curves of different crime types. Due to the large volume of data contained in each figure, trends for men and women are discussed separately.

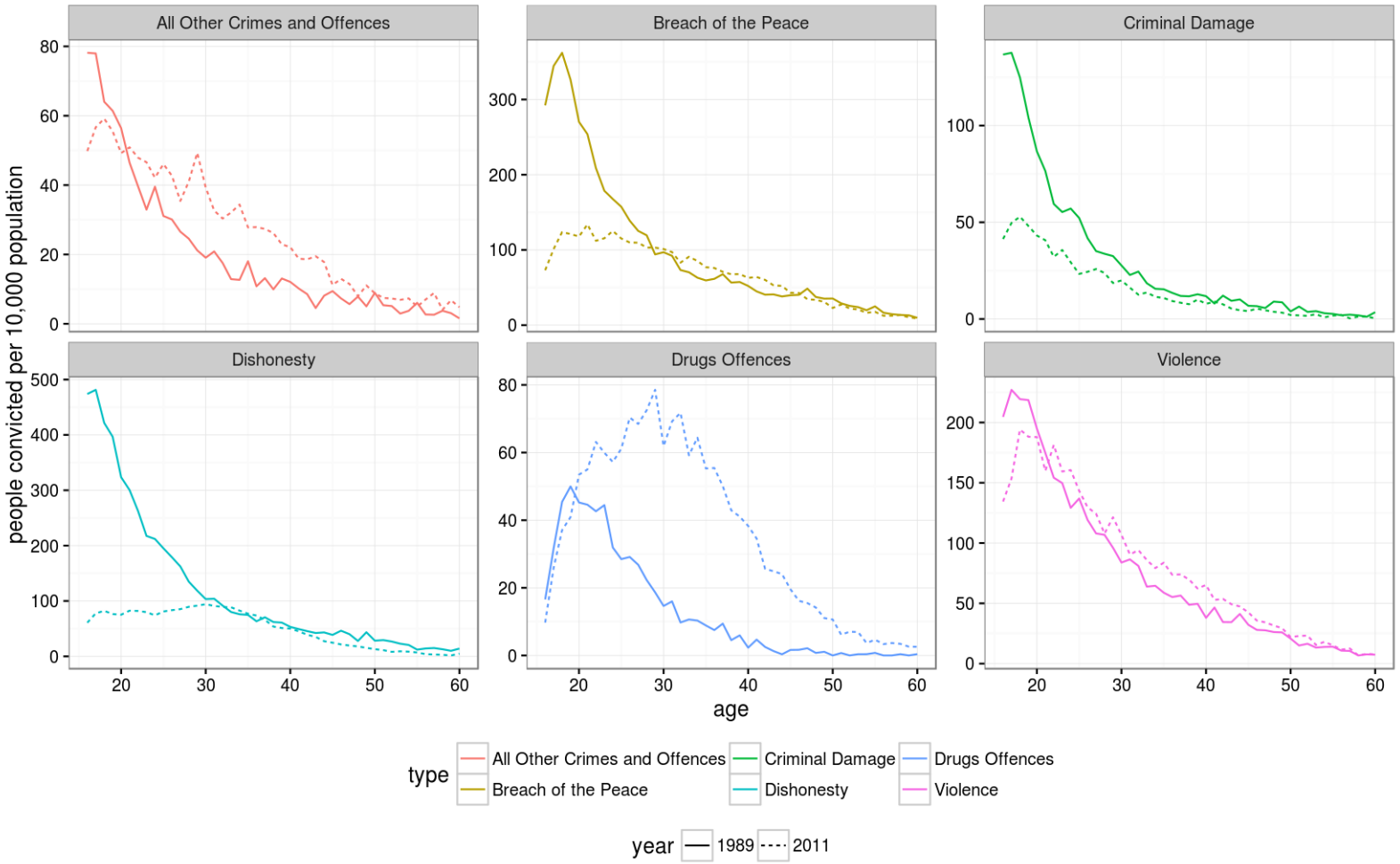

Figure 6.2. Age-crime curves for different crime types in SOI 1989-2011, men

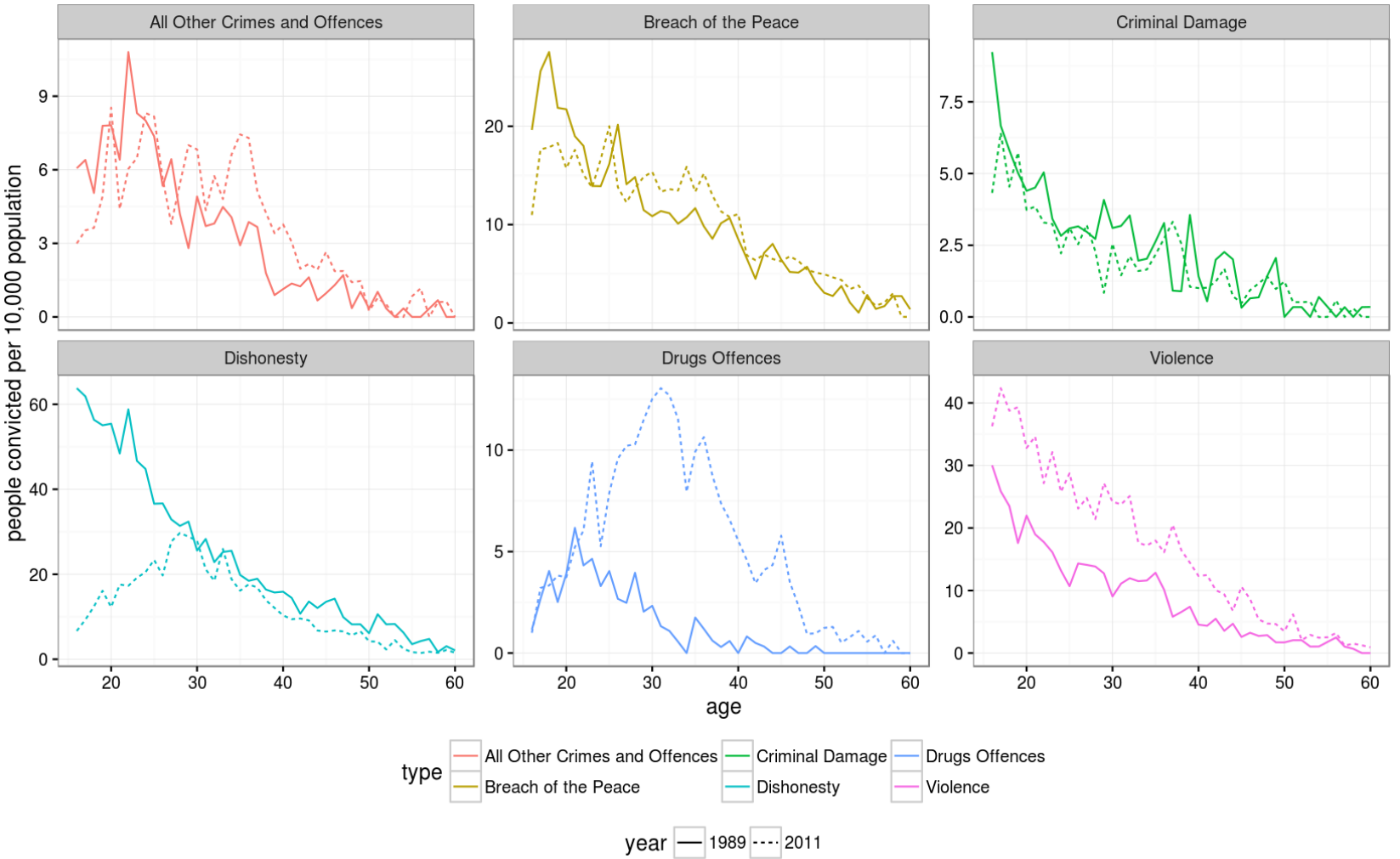

Figure 6.3. Age-crime curves for different crime types in SOI 1989-2011, women

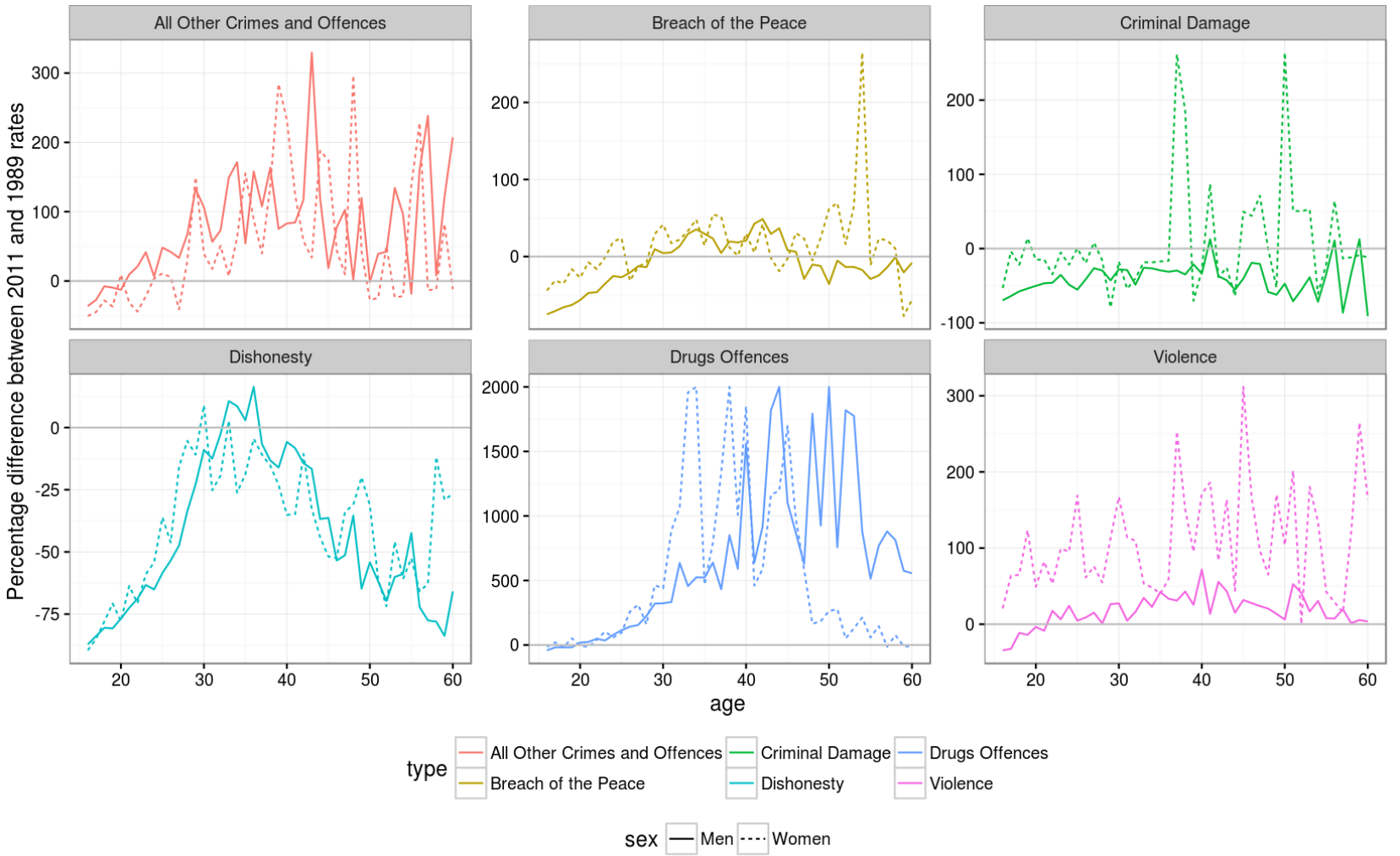

Figure 6.4. Comparison of percentage change in prevalence of conviction rates in SOI 1989-2011

Men

Three crime types show marked declines in rates of convicted offences for young men: dishonesty, breach of the peace and criminal damage. Drugs offences show substantial increases in conviction rates, whilst the two other crime types analysed – all other crimes and offences, and violence – show little change. Dishonesty shows the greatest drop in youth convictions between 1989 and 2011, with a conviction rate of 77.7 per 10,000 for 17 year-old men in 2011, a drop of 83.8% from the 1989 rate. The peak rate of convicted offending for breach of the peace is 362.1 for those age 18 in 1989, which declines by 65.8% to a rate of 123.7 for 18 year-olds in 2011. Similarly, criminal damage shows a marked decline in youth crime, falling from a conviction rate of 137.6 for 17 year-olds in 1989 to 50.0 for the same age in 2011. Of these three crime types, dishonesty and breach of the peace show very little decline in rates of convicted offences for those over age 30, and for some ages show slight increases in rates of convicted offending. Criminal damage shows declines in convicted offending rates for across all ages, but with a relatively greater decline for those under 20 than between 20 and 40 (see Figure 6.4)

All other crimes and offences and violence show similar patterns, with declines of 32% for 16 and 17 year-olds respectively. For all other crimes and offences those aged 25 to 40 show increases of between 50 and 200%, whilst the same age range for violence show more modest increases, with a maximum difference of 50%. Drugs offences show a much more extreme picture of change, with very slight declines in rates of convicted offences between age 16 and 19 followed by substantial increases in the rate of convicted offending for all other ages. The peak of convictions in 2011 was 78.5 for 29 year-old men, and the same age had a conviction rate of only 18.7 in 1989, an increase of almost 320%.

These results show that overall falls in rates of youth convictions are seen across all crime types, but much more so for dishonesty, breach of the peace and criminal damage. Similarly, overall increases in prevalence for those between the ages of 25 to 40 are seen to some extent for all crime types, but proportionally more so for violence, all other crimes and offences and, in particular, drugs offences.

Women

A notable difference between age-crime curves for women and men is that trends for women are less clear cut. This is due to the greater fluctuation in trends caused by the smaller numbers of women convicted. As with Figure 6.2, Figure 6.3 also shows substantial variation in rates of change across crime types between 1989 and 2011. Similar to men, there are sharp declines in rates of convicted offences for dishonesty for women below the age of 30. However, the substantial declines in breach of the peace and criminal damage seen for young men are not replicated for young women. This observation is reinforced by Figure 6.4. which shows that rates of convicted offending for breach of the peace for women are lower in 2011 than 1989 for ages 16 to 23, but in 2011 conviction rates for breach of the peace were higher for women of older ages.

Of the three other crime types analysed, the most notable differences between men and women is in the patterns of change across age for violence. From Figures 6.3. and 6.4[116]. we see that women have a higher prevalence of convicted offending for violence between 1989 and 2011 at every age. This contrasts with the declines in convictions for youth violence seen for men. All other crimes and offences and drugs offences show similar trends for women as for men.

Comparing trends for men and women

Figures 6.2 to 6.4 show some similarities in change in the age-crime curve for men and women, particularly in falling convictions for dishonesty and increases in convictions for drugs offences, but also important differences, such as the increases in convictions for violence served to women. Importantly, the y-axes in Figures 6.2. and 6.3. show that different types of crime have very different prevalence rates. This is seen more clearly in the change in the rate at peak age[117] between 1989 and 2011. To facilitate comparison in the relative change of prevalence across crime types

116 Percentage increases in Figure 6.4 are capped at 2,000. This only affected three extreme values for Drugs Offences.

117 Trends in descriptive statistics are presented in full in Appendix Nine. This lists the age with the highest rate of conviction as listed in Table 6.3. In 2011 age-crime curves for all crime types are less skewed and have less kurtosis1, show higher standard deviations (with the exception of dishonesty for women), display increases in half peak after, 25th and 75th percentiles, and all show increases in the mean, median and modal age of conviction, with the exception of the modal age of conviction for women for all other crimes and offences. The combined effect of these different patterns of change across crime type has been to produce age distributions which are less dominated by youth convicted offending.

between men and women, Table 6.3 presents the percentage change in prevalence a the peak rate of offending.

The results presented in this table provide two key insights for this chapter. First, these results show that for all crime types falls in prevalence at the peak age of offending is relatively lower for women than for men, as shown by the lower values for women in the Percent column. When conviction rates for both men and women increase, as in the case of drugs offences, the increase is greater for women. Moreover, for violence the conviction rate at the peak age declines for men whilst increase by more than 40% for women. This agrees with the observation of a declining gender gap in violence as seen by Lauritsen et al. (2009) in the USA. However, in Lauritsen et al.'s (2009) analysis violent offending by women also fell but not as rapidly as men, whilst in the SOI convictions for violent offending increase for men and even more so for women. A possible explanation for this discrepancy may be an increasing willingness to sanction violence committed by women. This trend is described by Steffensmeier et al. (2005) in the USA, although it is not known if this explanation would also apply to Scotland.

Second, as a result of uneven trends seen for different crime types, the mix of convictions in SOI is much more even in 2011 than it was in 1989. This can be identified from the Rank columns in Table 6.3. These figures show that dishonesty had the highest prevalence rate at peak age for both men and women in 1989, whilst for men in 2011 dishonesty had the third highest rate at peak age, and for women it had the second highest. For both men and women violence has the highest rates of convicted offending in 2011, after being the third (men) and second (women) most prevalent crime type in 1989. These differences across crime types in the shape of the age-crime curve between 1989 and 2011 suggest that the relative importance of crimes of dishonesty to the composition of the overall age-crime curve has declined over the period of the crime drop. As a result of the differences in the magnitude of change over time across crime types, the mix of convictions in the population has become much more even.

Taking these trends together, as shown by falls in the conviction rate at peak age the youth crime drop for men is primarily a function of dishonesty, then breach of the

peace and criminal damage. All other crimes and offences and violence also show declines, but of a smaller magnitude, whilst the rate of conviction for drugs offences increases. For women the youth crime drop is primarily due to falling rates of convictions for dishonesty, with all other crimes and offences, breach of the peace and criminal damage also falling. In contrast to men, the rate of conviction for violence increases, as does drugs offences. Increases in convictions for men and women between their mid-twenties and forties reflect increases in convictions for drugs offences, all other crimes and offences and, particularly for women, violence as well as a lack of decline in conviction rates for breach of the peace. Despite substantial falls in the prevalence of conviction for crimes of dishonesty for young men and women, this crime type shows stability in prevalence between the late-twenties and mid-thirties, with older ages showing substantial falls in conviction rates.

Table 6.3. Change in the rate of convicted offending at peak age 1989-2011 for men and women across crime types

Type	Men					
	Year				Difference	
	1989		2011			
	Rate	Rank	Rate	Rank	Rate	Percent
Dishonesty	481.39	1	94.16	3	-387.24	-80.44
Breach of the peace	362.08	2	133.96	2	-228.12	-63
Violence	227.1	3	194.22	1	-32.87	-14.48
Criminal Damage	137.62	4	52.89	6	-84.73	-61.57
All other crimes and offences	78.15	5	59.16	5	-18.99	-24.3
Drugs offences	49.98	6	78.55	4	28.57	57.16
Type	Women					
	Year				Difference	
	1989		2011			
	Rate	Rank	Rate	Rank	Rate	Percent
Dishonesty	63.79	1	29.72	2	-34.08	-53.42
Violence	30.02	2	42.36	1	12.34	41.1
Breach of the peace	27.55	3	20.01	3	-7.54	-27.37
All other crimes and offences	10.8	4	8.53	5	-2.27	-21.01
Criminal Damage	9.24	5	6.417	6	-2.82	-30.52
Drugs offences	6.17	6	13.05	4	6.88	111.49

Source: SOI.

These results show that the overall drop in convictions has been underpinned by important differences across different types of crimes, in the same way as described by Aebi and Linde (2010, 2012). Similar to Farrell et al. (2015), these results show that different crime types have shown differences in the age distribution of conviction, and stress that crimes of dishonesty in particular play an important role in declines in overall rates of convictions. The analysis presented above has also shown important differences between men and women in the magnitude of these changes across different types of crime. What the analysis so far cannot show is when these changes across the age distribution of conviction between 1989 and 2011 occurred. This is the focus of the next section of this chapter.

6.4 Annual change in the age-crime curve 1989-2011

So far this analysis has focused on comparing the first and last years covered by SOI. Figure 6.5 shows a shaded contour plot showing the age specific conviction rates for each single age from 16 to 60 years, and each year from 1989 to 2012. Year runs left-to-right on the x axis, and age runs low to high on the y axis. The colouring indicate each of the individual age, year and sex specific offending rates (per 10,000 population), with warmer colours (red and orange) showing higher rates of convicted offences, and cooler colours (green and blue) showing lower conviction rates. Contour lines link together positions across the contour plot of equal height, labelled with their corresponding values. Contour lines are provided for every change in rates of 50 convicted men per 10,000 population and every 10 convicted women per 10,000.

Looking from the bottom of the plot to the top we can see that contour lines are mostly horizontal, showing the typical age effect that would be expected from the age-crime curve. Looking left-to-right shows that the overall change in the age-crime curve seen in Figure 6.5 does not occur linearly between 1989 and 2011. Instead, the dynamics of change form three reasonably distinct periods of change in the data between 1989 and 2000, 2001 to 2006 and 2007 to 2011. These periods are marked on the contour plot by vertical lines, and are characterized by different trends in convictions between those in their mid-twenties and younger, and those from their mid-twenties to their early forties.

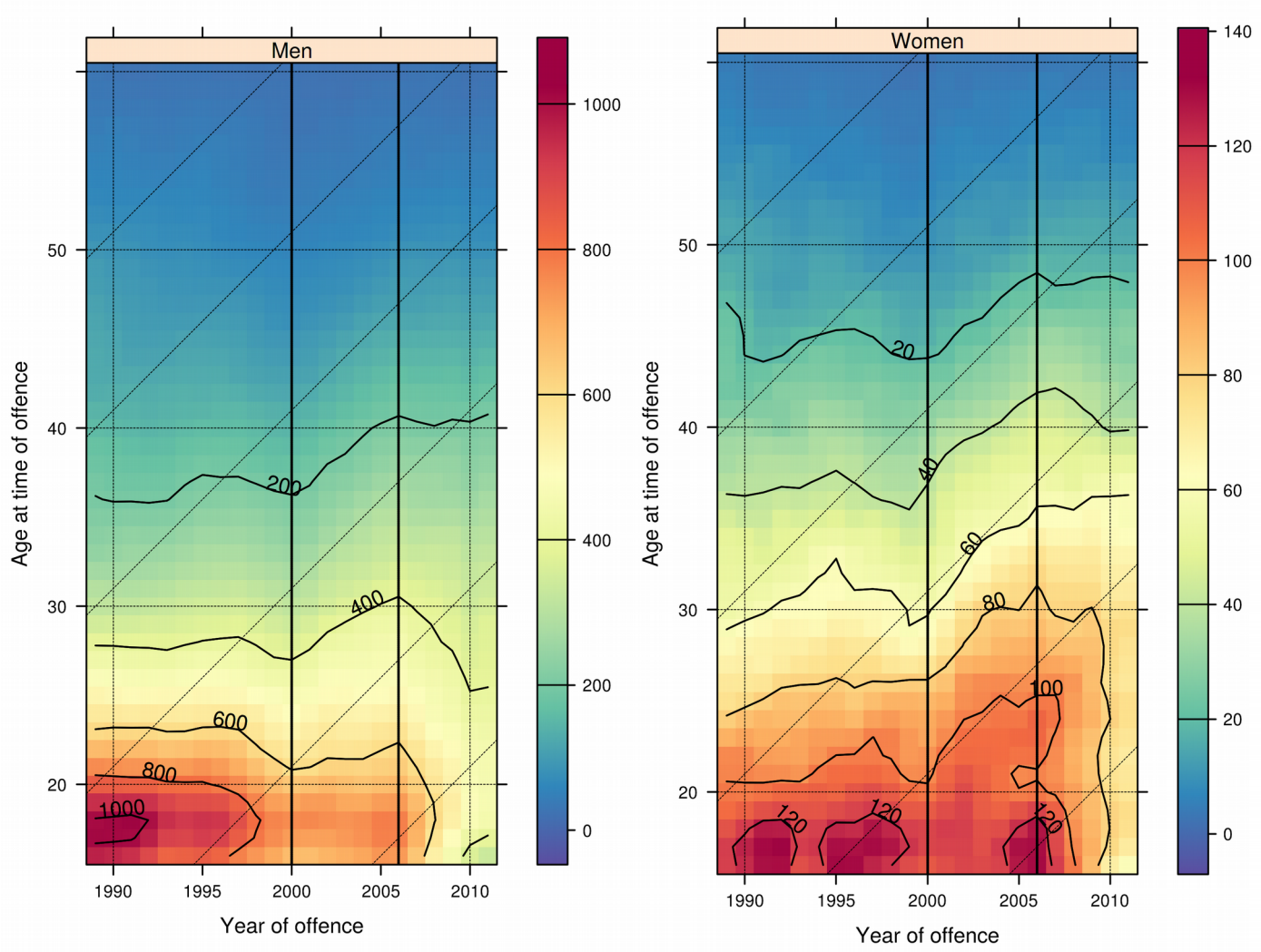

Figure 6.5. Shaded contour plot of convicted offending for different ages in SOI, 1989-2011.

Period One: Declining prevalence for young men

The period from 1989-2000 shows a marked decline in rates of convicted offending for young men. We can see this in the contour plot by looking at the peaks of convictions, centred on the years 1991 and 1996 at around age 18, and the dip in the contour lines for those age 18 in 2000. The highest contours in these peaks are labelled 1,000 and 950, whilst the highest contour in 2000 is labelled 700. This shows a decline in rates of conviction for men in their late teens between 1989 and 2000. Comparing these peaks to the equivalent ages and year for women we can see that the rates of convicted offences at these ages are consistently between 120 and 130. During the 1990s, when convicted offending rates for young men dropped by almost a quarter[118], the convicted offending rate for young women was essentially static[119]. In contrast to these declines in youth convictions, over this period the contour lines for those age 22 and above show very little change for both men and women demonstrating that these declines in conviction rate are not present for older adults. The contour plot suggests that this change is best described as an age-limited period effect. Cohort effects would be manifest in diagonal contours, or if there was a strong interaction between cohort effects and age effects, vertical contours (see Chapter Five).The horizontal contours (for example, at age 20) which run from 1995 to 1997 indicate that those only a few years older than the late teens had a consistent rate of conviction even while the conviction rate at the peak age fluctuated.

Period Two: increasing prevalence for men and women aged 25-40

Between 2001 and 2006 there is a distinct change in trends in rates of convicted offending compared to the period 1989-2000. First, the decline in youth convictions for men stops; the highest contour in 2006 for men is labelled 800 the same value as the contour in 2001. Conviction rates for young women are also stable in this period, and indeed by 2006 there has been very little decline in rates of convicted offending by young women since 1989. Second, conviction rates for men and women in their mid-twenties to early forties increase. We can see this in the diagonal trend in the contour lines for both men and women over the age of 20 after 2000. For example, for men aged 30 in 2000 the nearest contour line shows a conviction rate of 300 per

118 From the raw data not presented here, the decline is from a rate of 1,043 for 17 year old men in 1989 to a rate of 741 in 2000.

119 A rate of 117 per 10,000 for 17 year old women in 2000, up from 116 per 10,000 in 1989.

10,000, but by 2006 the closest contour line for 30 year-old men is for 400 convictions. The overall change that we see in convicted offences for men and women in their mid-twenties to forties in Figure 6.1. occurs entirely in this period. Increases in rates of convicted offending across age starting at the same time suggests an age-limited period effect – that is, a change affecting all ages in the same year (see Chapter Four) – with the diagonal lines caused by period effects interacting with the strong age effect of the age-crime curve.

Period Three: declining prevalence for young men and young women

The final period spans from 2007 until 2011. This period is marked by rapid declines in rates of convicted offences for both men and women under twenty but stable rates of convicted offending for ages 30 and above. This is shown by the concentration of contour lines in the bottom right of the plot for men, and the sharp vertical turn in the contour line labelled 70 for women. For men there is a marked decline in rates of convicted offending for ages 20 and above in 2010, but by 2011 rates of convicted offences have returned to close to their 2009 levels. Compared to the initial period of declining rates of convicted offences during the 1990s, this period shows an even greater magnitude of decline in rates of convicted offences for young men. From the highest contour of convictions at age 18 in 1991, the conviction rate declines to between 70 and 80% of its peak in 2000, a drop of between 250 and 300 convictions per 10,000. Between 2006 and 2011 – a much shorter time-span – rates of convicted offences for 18 year old men decline from between 800 to 850 to between 450 and 500. This is a decline of a greater magnitude in a shorter period of time. Taking the same years as a comparison, the drop is even more marked for women. The 2006 conviction rate for 18 year old women was higher than 130, down to below 70 in 2011. Almost all of the declines in the age-crime curve that we see for young women in Figure 6.1. occur in this period. In contrast to this decline for young people, rates of convicted offending for both men and women over thirty remain close to their rates from 2006, shown by the mostly horizontal contours for men above this age, and the horizontal contour for women labelled 60 and 50.

Compared to Figure 6.1. which shows aggregate difference between 1989 and 2011, Figure 6.5. shows much more of a drop in youth convictions for women since 2007. This is due to the increase in convictions for young women in the mid-2000s. The

conviction rate for 17 year-old women in 2005 was the highest at any point between 1989 and 2011 (around 130 per 10,000), but by 2011 it was down to half this rate (60 per 10,000).

This final period also shows a different pattern of contours than the crime drop though the 1990s. After 2007 there are a number of vertical contours (see those labelled 500 for men and 70 for women) for both men and women and unlabelled diagonal contours at the very bottom right of the plot. These trends suggest potentially a cohort effect of younger cohorts with lower conviction rates interacting with the typical age effect of the age-crime curve. Based purely on visual analysis of shaded contour plots it is not possible to definitively ascribe different effects to these patterns of contours. What these results do demonstrate though is that the final period of falling youth crime represents a different pattern of change to the period of falling youth convictions from 1989 to 2000. Overall, Figure 6.5 presents a complex picture of change over time. To provide further insight into the development of the crime drop over age, the next section examines shaded contour plots for different types of crime.

6.5 Annual change in the age-crime curve 1989-2011, different types of crime

This section extends the analysis presented in section 6.3 to examine annual change in the age-crime curve for different types of crime between 1989 and 2011. In Figure 6.6 and 6.7 below, prevalence is standardized[120] so that the highest age-specific conviction rate for each crime type is set to one, allowing the straightforward comparison of trends across crime types without trends for less frequent crime types being obscured by more common crime types. When interpreting these figures the differences in volume of different crime types as discussed in Section 6.2 should be remembered.

Due to the large volume of data presented in this analysis, results are discussed first for men and then for women. These results show different schedules of change for different crime types. The first period of falling convictions identified above (1989-2000) was primarily due to declining rates of convicted offending for dishonesty, which is seen for young men and to a lesser degree by young women. For young

120 Unstandardized figures are presented in Appendix 10.

women these falls in convictions for dishonesty are offset by increases in the prevalence of conviction for other crime types. In contrast, the second period of drop in convictions (2007-2011) is driven by declines in the prevalence of convictions across all crime types for both young men and young women. Between these two periods of decline is a time of increase in the prevalence across crime types for both men and women and across age. These results emphasise the differences in conviction trends between these two periods of falling convictions.

Annual change in the age-crime curve across different crime types: men

Figure 6.6 illustrates that different types of crime show very different patterns of change over time. The simplest way to see these different schedules of change in Figure 6.6 is by the different locations of the peaks of prevalence for different crime types, represented by red shading and contour labels close to 1. Dishonesty shows a single peak for young men in 1991, after which point prevalence of convictions for dishonesty for young men decline until 2011. Similar to dishonesty, breach of the peace has a peak of convictions for young men in 1990, but convictions for breach of the peace peak again, albeit at lower levels, in 1996 and 2005. In contrast, violence, all other crimes and offences and criminal damage all show peaks of prevalence between the ages of 16 and 18 in 2005. Different again, for drugs offences the peak of convicted offending is between age 18 to 20 from 1993 to 1997. This reinforces the point that the three periods identified above have different trends across types of crime, and trends for these different periods are now discussed in turn.

Period One: declining crimes of dishonesty for young men

Figure 6.6 shows that the first period of declining convictions (1989-2000) is primarily due to falls in the conviction rate for dishonesty amongst young men. As described above, there is a very distinct peak of convictions for dishonesty between the ages of 16 and 19 from the start of the data to around 1994. After 1997 rates of convicted offences for men of this age range continue to decline but at a slower rate, evidenced by the contour lines becoming more spread out. By 2000 the conviction rate for dishonesty for men aged 17 is around 40% of the 1991 rate. This sustained decline in rates of convicted offences for crimes of dishonesty is a very marked difference to the patterns shown by men aged 32 and over, which show no declines

in rates of convicted offences during this period. Figure 6.6 shows little change in the prevalence of convictions for all other crimes and offences, violence or criminal damage during period one. There is a drop in the prevalence of convictions for breach of the peace, which are close to half their 1990 rate for men age 18 by 2000. Figure 6.2 showed that dishonesty was a more common crime type than breach of the peace in 1989, and so declines in breach of the peace will have less of an impact on overall falls in conviction than decreases in convictions for dishonesty. Drugs offences show a pattern unlike the other offence types with strong diagonal trends beginning in this period and continuing through the whole period covered by SOI. This is seen especially for the contour lines marked 0.30 in Figure 6.6. and lower (the cohorts around 23 in 1989), suggesting a distinct cohort effect.

That falls in prevalence are concentrated in crimes of dishonesty is in line with the description of the crime drop in the securitization thesis (Farrell et al. 2014). Moreover, there is little plausible policy mechanism that would account for these trends as a system effect acting only on crimes of dishonesty (see Chapter Three). However, there does not seem to be any knock-on effect of from reductions in crimes of dishonesty to other crime types. This leads us to questions the keystone and début crimes hypotheses which predict such knock-on effects, at least when manifest to the aggregate level. Instead, falls in convictions for dishonesty appear to be self-contained within this crime type.

Period Two: increases in prevalence of convictions across crime types and age except crimes of dishonesty

The most notable trend between 2000 and 2006 is the increase in rates of convicted offending seen across all ages and crime types, with the exception of crimes of dishonesty, for men under the age of 25. This effect is seen most clearly in Figure 6.6 by the upward slope in contour lines for drugs offences, violence, all other crimes and offences and breach of the peace for ages 25 until 2006. These crime types also show a peak in youth convictions particularly between 2003 and 2007. Because increases in the prevalence of convictions for those 25 and above reflect change across all crime types, and as these increases in rates of conviction are seen across age and across crime type starting in the same year, this is most plausibly explained by a period effect. As discussed in Chapter Three, the presence of a period effect is

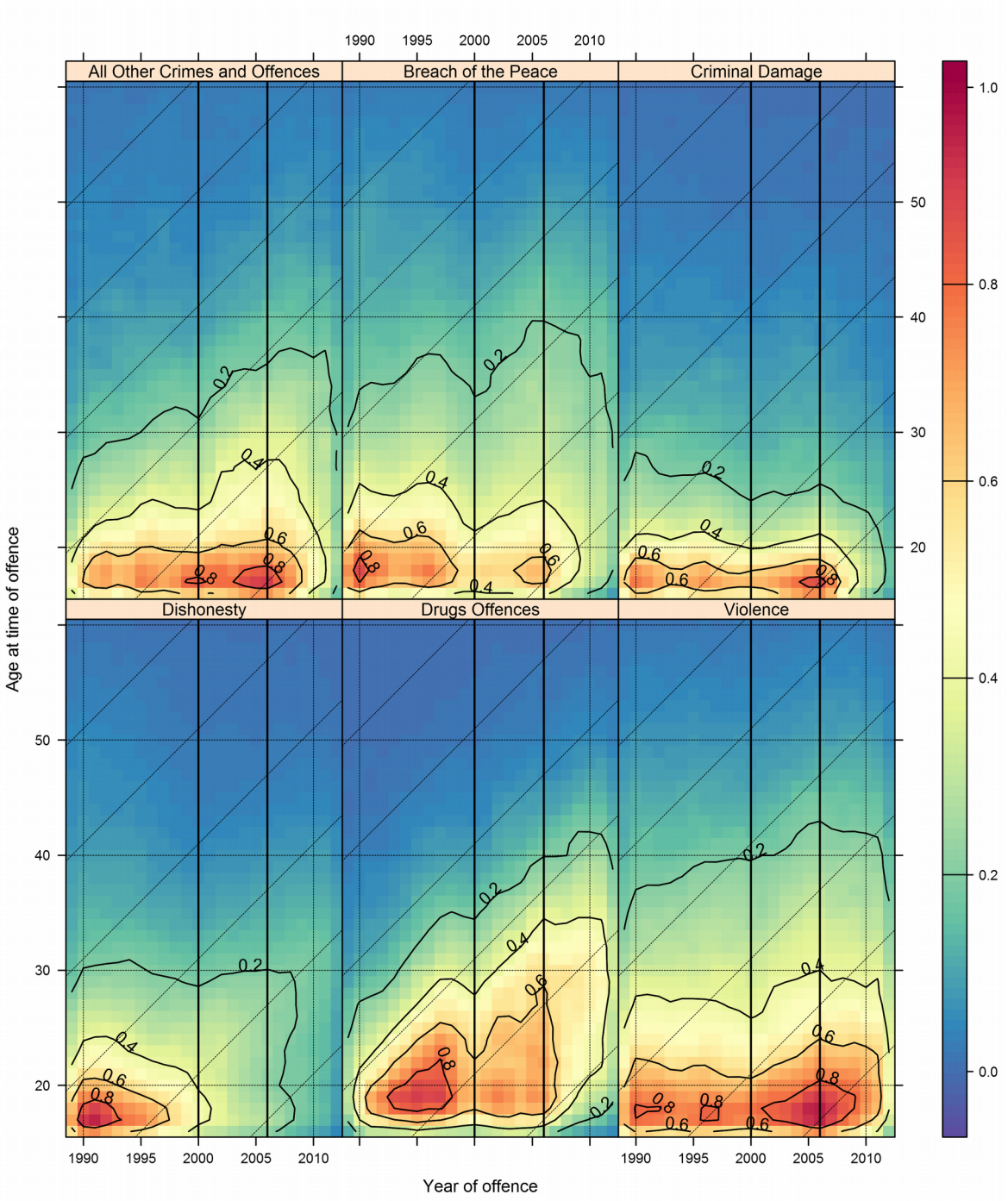

Figure 6.6. Shaded Contour Plot of prevalence of convicted offences (standardized) for different crime types in SOI 1989-2011, men

best explained by a system effect rather than a behavioural effect. This period coincides with the 'punitive turn' in Scottish justice policy (McAra 2016), which suggests that these increases in convictions may relate to either net-widening or recycling people through the justice system (see Chapter Three). That these increases are seen across crime types (with the exception of dishonesty, as discussed below) is in line with this general period effect. In the case of drugs offences, this period effect coincides with apparent cohort effects described above. This leads to a second set of peaks in the conviction rate for drugs offences between 2000 and 2006 marked by the contour lines around 0.70 between the ages of 18 and 22.

The trends observed for crimes of dishonesty are in marked contrast to those for other crime types during this period. Similar to other crime types there are slight increases in the prevalence of convicted offending above age 25, seen in the upwards slant of the 0.1 and 0.2 contours in Figure 6.6. However, for those under age 25 we continue to see declines in convicted offending, evidenced by the sharp vertical turn in the 0.3 contour, although the fall in crimes of dishonesty is less rapid during this period than in the 1990s. This is seen in the wider gaps between contour lines and the 'pan handle' turn in the 0.3 contour at age 17 in 2003. This vertical contour may indicate the start of a cohort effect combining with the typical decline of convictions with age (i.e. the age-crime curve). Whilst contour lines turn to run vertically in 2003, 2004, 2006 and 2010 respectively, the contour lines for those over the age of thirty continue to be horizontal, suggesting that whatever mechanism has led to this sharp decline in rates of convicted offending for dishonesty has not had the same effect for older men. It may also be that slower falls for conviction rates for dishonesty during this period show an interaction between a system effect increasing convictions for all crime types, and an underlying behavioural trend of falling convictions for dishonesty.

The overall result of these patterns of change is that the peak in overall youth convictions seen around 2005 in Figure 6.5 is much less due to crimes of dishonesty than the peak in 1991. Instead this peak reflects a combination of continued declines in convicted offending for crimes of dishonesty for young people and increases in convicted offending for all other crime types.

Period Three: declining prevalence across all crime types for young men

Figure 6.6 shows falls in convictions across all crime types for men aged 16 to 20 between 2007 and 2011. For every crime type except dishonesty, this comes after a peak of convicted offending for young men between 2004 and 2007. However, for each crime type there is very little change in convicted offending for those aged 30 and above in this period across all crime types, shown by the mostly horizontal contours above these ages (with the exception of the drop in convictions seen in 2010 in violence and breach of the peace). For violence, declines in prevalence do not extend above the age of 20. This makes it a sharp contrast to the decline in convictions between 1991 and 2000, which was primarily due to declines in crimes of dishonesty.

From Figure 6.6 it is not possible to conclusively determine whether these effects are period or cohort effects. The decline in youth convictions is primarily reflected in diagonal contours for breach of the peace, violence and drugs in Figure 6.6 whilst all other crimes and offences and criminal damage show vertical contours during this period. Dishonesty shows a combination of vertical and diagonal contours. Again, this complex picture makes it difficult to determine whether change in this period is due to a cohort or period effect. What these results do suggest is that causes of this second period of crime drop are likely to be different from first period of crime drop. These general falls across crime type raise the possibility of a more general mechanism relating to young people's behaviour, such as that described by Aebi and Linde (2010) as opposed to working particularly through crimes of dishonesty.

Annual change in the age-crime curve across different crime types: women

Turning now to examine annual change in the age-crime curve for women, Figure 6.7 shows age-specific prevalence rates for women, again standardized to show the peak age-specific rate of convictions for that crime type as a value of 1. When compared to Figure 6.6, Figure 6.7 looks less smooth. This is due to the lower absolute rates of convictions for women giving greater variability in the relative rates. Figures 6.7 again shows differences in the timings of change in the age-crime curve across different crime types. However, the schedules of these changes are different for women than for men.

Period One: declines in the prevalence of dishonesty for young women are offset by increases in the prevalence of convictions for other crime types

Figure 6.7 shows two prominent trends between 1989-2000. First, falls in crimes of dishonesty are seen for women, but of a lower magnitude than for men. For example, the figure for 17 year-old men in 2000 is just above the 0.4 contour (a value of 0.42), and for women it is just below the 0.6 contour (0.58) for the age of the same age in 2000. As with men these falls in dishonesty are only seen for young women between 1989 and 1997, again suggesting an age limited period effect rather than a cohort effect. The diagonal contours in dishonesty for young women from 1998 suggest a potential cohort effect in reducing conviction rates for dishonesty after that point.

Second, these declines in dishonesty are offset by increases in convictions for all other crime types. For example, for 16 year old women in 1989 the conviction rate for violence was only 40% of the 2005 conviction rate for violence. Between 1989-2000 conviction rates for violence for 16 year old men also increase (see Figure 6.6), but their 1989 rate is around 80% of their 2005 rate. We see then substantial increases in convictions for violence for young women, whilst for young men increases in convictions for violence are much smaller. The combined effect is that there is little change overall in the total prevalence of convictions for women under 25 between 1989 and 2000, as shown in Figure 6.5, as the combined effect of is less relative decline in crimes of dishonesty and greater relative increases in prevalence across other crime types, especially violence. These results again question whether there are knock-on effects of reductions in convictions for dishonesty to other crime types, as falling prevalence of conviction for dishonesty is not associated with falls in other types of crime for the same cohorts.

For those aged 25 and above there is little systematic trend in prevalence rates for women across crime types between 1989 and 2000. The exception to this is the increase in drugs offences which, as for men, also show notable diagonal contours. Again, this indicates a cohort effect for drugs offences for those born in the early 1990s, and demonstrates that this cohort effect is seen for both men and women.

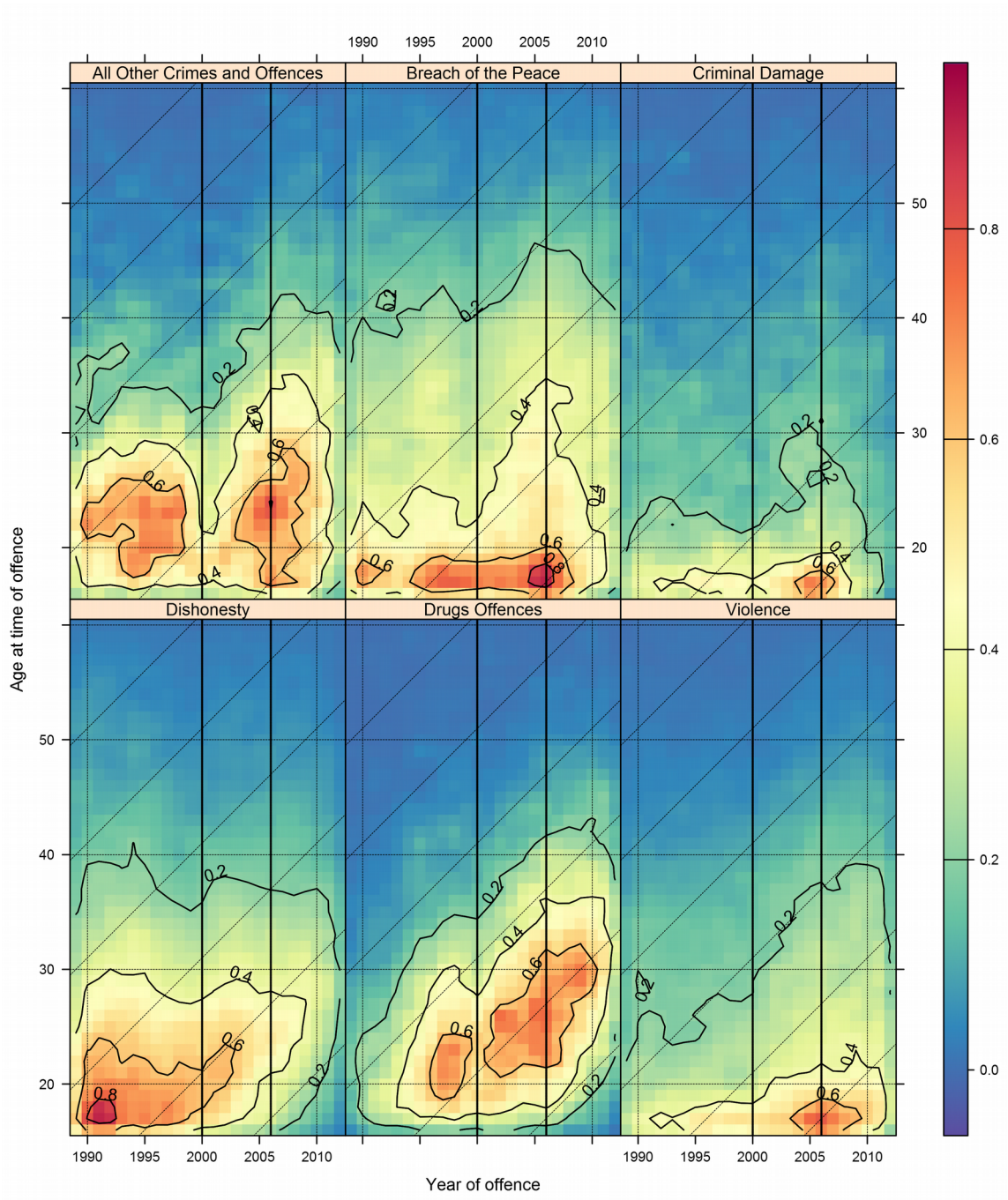

Figure 6.7. Shaded Contour Plot of prevalence of convicted offences (standardized) for different crime types in SOI 1989-2011, women

Period Two: increases in prevalence across crime types and ages, except dishonesty

Between 2000 and 2006 the dominant trend is of increases in the prevalence of convicted offending across all crime types and across most ages. This can be seen in the peaks in Figure 6.7 at around age 17 in 2005 for criminal damage, all other crimes and offences, breach of the peace and violence. For women aged 25 and above there are notable diagonal trends in contours across different types of crime. This rise in rates of convicted offences across age and crime type is similar to the trends seen for men during the same period, and this similarity in trends across sex as well as age and crime type reinforces the understanding of this trend as a period effect and so a system effect.

As with men, drugs, criminal damage and dishonesty deviate from the trends shown for other crime types. The prevalence of drugs convictions for women continues to be marked by diagonal lines during this period, again indicating a cohort effect. For criminal damage, there is little evidence of an increase in convictions for those from their mid-twenties and older. This may be due to the heavy skew of this crime type towards youth convictions (see Figure 6.3) meaning that increases in prevalence for older ages are not displayed prominently in the contour plot.

Interpreting trends for dishonesty during this period is more complicated. As discussed above, for men there are vertical contour lines in dishonesty in Figure 6.6 for those in their mid-twenties that begin around 2000 and then continue through to 2011. In contrast, Figure 6.7 shows diagonal contour lines for crimes of dishonesty for women in this age group starting in 1998. These diagonal lines show declines in rates of convicted offences across subsequent cohorts, but no decline in rates of convicted offences with age within these cohorts until their mid-to late twenties, shown by the horizontal contour lines marked 0.4 and 0.3. In other words, for these women the age-crime curve for dishonesty is effectively flat between 16 and 25. For the youngest women we see declines in dishonesty from the cohort that were aged 16 in 2000, but we do not see any declines for earlier cohorts in the SOI until they reach their late twenties. This suggests that whatever mechanism led to declines in convictions for the cohort aged 16 in 1998 did not affect rates of convicted offences for older cohorts. These trends also differ from the declines in the prevalence of

dishonesty seen for women between 1989 and 2000, which did not show these diagonal contours.

One possible explanation is that these different trends for men and women represent differences between particular crimes included in the category of Dishonesty. Shaded contour plots focusing on the two most frequent crimes of dishonesty (shoplifting and other theft), as well as trends for all other offences classed as crimes of dishonesty, are presented in Appendix 11. In particular, shoplifting shows a cohort effect similar to drugs but unlike other crimes of dishonesty. This observation highlights the complexity of trends in convictions rates, and raises the possibility of different mechanisms acting on different crimes classified within crime types at different times.

Period Three: declines in prevalence across all crime types for women under 20

Between 2007 and 2011 trends in convicted offending for women are very similar to those for men. The crime drop for young women seen between 2007 and 2011 is manifest across all crime types for women under 20. For drugs offences, dishonesty and breach of the peace these declines extend to the mid-twenties. However women over the age of 30 show very little signs of decline in convictions, with the exception of breach of the peace. This similarity across sex in the fall in convictions for young people between 2007 and 2011 reinforces the difference between conviction trends in this final period and those that occurred between 1989 and 2000.

6.6 Discussion

The analysis presented in this chapter suggests a number of important points as to how the aggregate age-crime curve has changed over the period of the crime drop in Scotland, and how we understand change in the age-crime curve over time more generally.

The age-crime curve and theories of the crime drop

First, these results have shown that convictions trends across age are very different in different periods. Rather than understanding the period covered by SOI purely as one of 'crime drop', the results in this chapter emphasise an important period of

increasing convictions between 2000 to 2007. That these increases in prevalence are seen across age, crime type and sex suggests a system effect (Soothill et al. 2004). Analysis in subsequent chapters will develop the understanding of this issue, and so a full discussion of the most likely mechanism leading to these effects is presented in Chapter 10.

The two periods of reductions in overall convictions are both driven by declining convictions amongst young people, but display differences in convictions patterns across crime type and sex. This observation emphasises that these different periods of crime drop may be best explained by different mechanisms (Humphreys et al. 2014). Again, this is a theme that is picked up again in Chapter 10. From this analysis it is difficult to disentangle differences between age-limited period effects and cohort effects, especially when trying to account for the typical age-effect of the age-crime curve. What these results do clearly show is that explanations for falling convictions in Scotland cannot plausibly be considered as period effects which led to lower conviction rates for all people.

Second, there is little evidence for the knock-on effect of crimes of dishonesty to other crime types implied by the keystone crime and début crime hypotheses (Farrell et al. 2014). As expressed by Farrell et al. the keystone and début crimes hypotheses are explanations for patterns of crime at the individual level, and the analysis presented in this chapter has focused on the aggregate level. However, as these hypotheses are presented as explaining falls in *aggregate* crime rates it is legitimate to expect that the effects of the keystone and début crime hypotheses should be apparent in the results of this analysis. There are no such knock-on effects of falling convictions for dishonesty upon other types of crime evident in the SOI between 1989-2000. Falls in convictions across crime types are seen for young people after 2007, but from Farrell et al.'s discussion of the keystone and début crime hypotheses there is no plausible explanation for why these effects would be seen only after 2007.

Third, one possible explanation for the general falls in youth conviction since 2007 is that the multifactor explanation offered by Aebi and Linde (2010) may have reduced crimes of all types for young people since 2007. For example, for young people in

Scotland drug and alcohol consumption has declined since the mid-2000s (see Chapter Three). These trends may represent the consolidation effect described by Farrell et al. (2014), with initial falls in crime during the 1990s due to changing security practices and subsequent falls attributable to changing patterns of young people's recreational activities. These results also suggest that the factors Aebi and Linde (2010) describe as reducing crime for young people may have different effects for older people. This is suggested by the cohort effects seen for drugs offences. Such effects fit with Morgan's (2014) account of the waxing and waning of the heroin epidemic in the UK. These cohort effects though are very different from trends observed for other crime types, and so have a limited capacity to be generalized beyond drugs convictions.

When used as a lens through which to understand changes in aggregate crime rates, short-term variation in the age-crime curve is meaningful

The results presented here show that it is valuable to examine annual change in the age-crime curve over time, given the substantial change observed in relatively short periods of time. Over a period of five years (2007-2011) there is substantial change in the age-crime curve for men and women. This questions the assertion of Ulmer and Steffensmeier (2014:382) that "historical changes in the age-crime curve are likely gradual and can be detected only when a sufficiently large time frame is used". This cannot be considered accurate when read either as a proscription of the analysis of disparate time points or if requiring a long time period for analysis. Moreover, identification of the trends in the prevalence of convictions discussed in this chapter would not be possible when using disparate time points, and focus on change in the age-crime curve across wide time periods selected without theoretical justification may lead to erroneous conclusions as to the location of turning points in convictions trends. As such the analysis of annual change is a more appropriate way to describe change in the age-crime curve over time without having to decide on only a small number of time points *ex ante*, and shaded contour plots provide an intuitive way to conduct such analysis.

Criminologists should not assume the presence of a sharply and increasingly peaked age-crime curve

Whilst the aims of this study are different from who analysed change in the age-

crime curve as part of the variance/invariance debate (see Chapter Two), the scale of the change in the age-crime curve demonstrated here is in-keeping with a perspective which emphasises the empirical variation in the relationship between age and crime at the aggregate level (for example Farrington 1986) and treats annual variation in the age-crime curve as a subject worthy of study. Whilst it may be that the causal effect of age and crime is the same in 2011 as it was in 1989 (Gottfredson and Hirschi 1990), the way the relationship between age and crime at the individual level is manifest in aggregate patterns of convicted offending is very different. This variation is to such a degree that, whilst Loeber and Farrington's (2014) description of the curve as peaking in the teenage years and then declining from the late-teens or early twenties still holds, the 'peak' of the aggregate age-crime curve is now almost flat. This observation may have important implications for our understandings of developmental criminology. For example, Moffitt's (1993) dual taxonomy theory was developed in part to explain the mass onset of offending during adolescence which was assumed to cause the distinctive peak of the age-crime curve, in part drawing on the observation that the age-crime curve has become increasingly peaked over time (1993:691). This is not to say that the results presented here invalidate Moffitt's theory: they do not. What they do suggest is that a new set of explanations may need to be found for a decreasingly peaked age-crime curve, rather than an increasingly peaked one.

6.7 Conclusions

In answering the research question 'How has the aggregate age-crime curve changed over the course of the crime drop in Scotland for men and women and across crime type?' this chapter has outlined a complex picture of change in the prevalence of convicted offending over the course of the crime drop in Scotland. Patterns of change vary by sex, age and over different periods, with overall declines in convictions being driven primarily by declining convictions for crimes of dishonesty served to young men in the 1990s, and by declines in convicted offending for both young men and young women across all types of crime from 2007 onwards. These declines in youth conviction obscure increases in the rates of convicted offending for those from their mid-twenties to early forties that occur across all types of crime from 2000 to 2006. These results show important changes in the age-crime curve over the course of the crime drop, and this change in the age profile of people

convicted must be accounted for by theories of the crime drop.

Original contribution

This chapter has made three important contributions to the literature analysing change in the age-crime curve over the course of the crime drop: analysing data in a previously unexamined jurisdiction; by analysing annual rather than sporadic variation; and by considering trends separately for men and women. Declining youth crime is common to the USA, Scotland and a number of other countries in Europe, but increases in rates of convicted offending for those from their mid-twenties to their early forties in Scotland has not been seen in previous analysis conducted in the USA. This questions the extent to which findings of US studies are generalizable to other contexts without modification, and highlights the importance of further replication of the kind of analysis presented here. The results presented here show the value of empirically assessing annual change in the age-crime curve, demonstrating that change in the age-crime curve over the crime drop has not been a linear process but rather one that seems to have operated in distinct periods. This questions previous assertions that long time periods were required to see meaningful change in the age-crime curve (Ulmer and Steffensmeier 2014). Finally, examining change for men and women separately has shown similar overall patterns of change in convictions for men and women, but of differing magnitudes and differing timings. This finding highlights the value of accounting for both age and gender when analysing change in convictions patterns over time and helps to reconcile the previous findings of both declining youth crime and a declining gender gap in offending.

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These divergent trends across age and sex are themes which are developed throughout this thesis. The first step in extending this analysis is to examine change in the frequency of conviction in conjunction with the changes in prevalence explored here. This is the subject of the following chapter.

Chapter 7. Prevalence, Frequency and Age-Structure: The Anatomy of the Crime Drop

7.1 Introduction

This chapter answers the research question 'What are the contributions of prevalence, frequency and age-structure to falling conviction rates?' This analysis splits the crime drop into the different parts of its "anatomy" – prevalence, frequency (Berg et al. 2016) and age-structure (Blumstein et al. 1988a) – and assesses their different contributions to overall declines in conviction rates in Scotland between 1989 and 2011. This adds context to the analysis presented in of Chapter Six by exploring the interaction of changes in prevalence with simultaneous changes in frequency and age structure.

The findings presented in this chapter will show that comparing the effects of age structure, prevalence and frequency shows that all three elements contributed to the decline in convicted offending between 1989-2011, with a drop in prevalence playing the largest role in reducing convicted offending rates. Change in age-structure was also an important factor in reducing convicted offending rates through the 1990s but it had only had a minimal impact in reducing conviction rates since 2007. There was little impact of change in frequency reducing conviction rates. There are important differences in the influences of these three factors between men and women and over time. For men, prevalence is the most important factor driving change in conviction rates. For women, when comparing the years 1989 and 2011, the most important factor is age structure, with little change attributable to prevalence or frequency comparing. When analysis is conducted in the three periods identified in Chapter Six (1989-2000, 2000-2007 and 2007-2011), however, prevalence has an effect of increasing conviction rates for women between 2000 and 2007, and then decreasing conviction rates between 2007 and 2011.

The chapter is split into three sections. The first presents descriptive statistics for change in the frequency of conviction and change in age-structure in Scotland between 1989-2011[121]. The second section presents the results of a standardization

121 Changes in prevalence are described in Chapter Six.

and decomposition analysis (see Chapter Five) separating out the different effects of change in age structure, prevalence and frequency on overall rates of convicted offending. This analysis first presents the aggregate contribution of these factors and then their age-specific contributions. Standardization and decomposition analyses describe overall patterns of change between 1989 and 2011 and then, to account for potential non-linearity in these trends, this analysis is repeated for 1989-2000, 2000-2007 and 2007-2011. Finally, Section 7.3 discusses these findings, linking them back to the literature discussed in Chapters Two and Three, and to our understanding of how prevalence and frequency have changed over the course of the crime drop.

7.2 Descriptive statistics for frequency and age-structure

This section presents descriptive statistics showing change in the frequency of convicted offending and of changes in the size of the population in Scotland between 1989 and 2011[122]. Frequency of conviction is presented first for the years 1989 and 2011 for all convictions, and then broken down by different types of crime. Annual change is then investigated in the form of a shaded contour plot showing age-specific frequency rates between 1989 and 2011. Change in age-structure between 1989 and 2011 is displayed using a shaded contour plot.

Frequency of all conviction, 1989 and 2011

Figure 7.1 compares the average number of convictions per person convicted (see Chapter Four) for men and women aged 16-60 in the years 1989 and 2011. The solid grey lines show the values for 1989 and the black dashed lines represent the year 2011. Figure 7.1 illustrates a substantial difference in the frequency of conviction between these two time points for men under the age of 40 and a small difference for women under the age of 25, but there is less difference between 1989 and 2011 evident for men over the age of 40 and women over the age of 25.

First looking at men, we see differing patterns of change by age. The most obvious difference between 1989 and 2011 is the decline in the frequency of convictions for those aged 27 and below. In 1989, there was a sharp peak of frequency at age 16 (just

122 Change in prevalence is the subject of Chapter Six, and so is not repeated here.

less than 1.7 convictions per person convicted) which declined rapidly to a frequency of 1.4 convictions per person convicted at age 20. After age 20 the frequency of conviction decreased steadily with age, to a rate of around 1.2 convictions per person convicted by age 30, remaining around this value for older ages. By 2011, the frequency of convictions for 16 year old men had fallen to just over 1.3 per person convicted, dropping marginally to around 1.25 at age 20. However, the frequency of convicted offending for men in 2011 increases from around 1.25 for those age 25 to a frequency of roughly 1.35 at age 30, after which time it gradually declines until age 50. As a result, men in 2011 have a higher average number of convictions per person convicted between the ages of 27 and 42 than men in 1989. The overall pattern is similar to that seen for prevalence, with falling frequency of conviction for young men but modest increases in frequency for men in their late twenties to early forties.

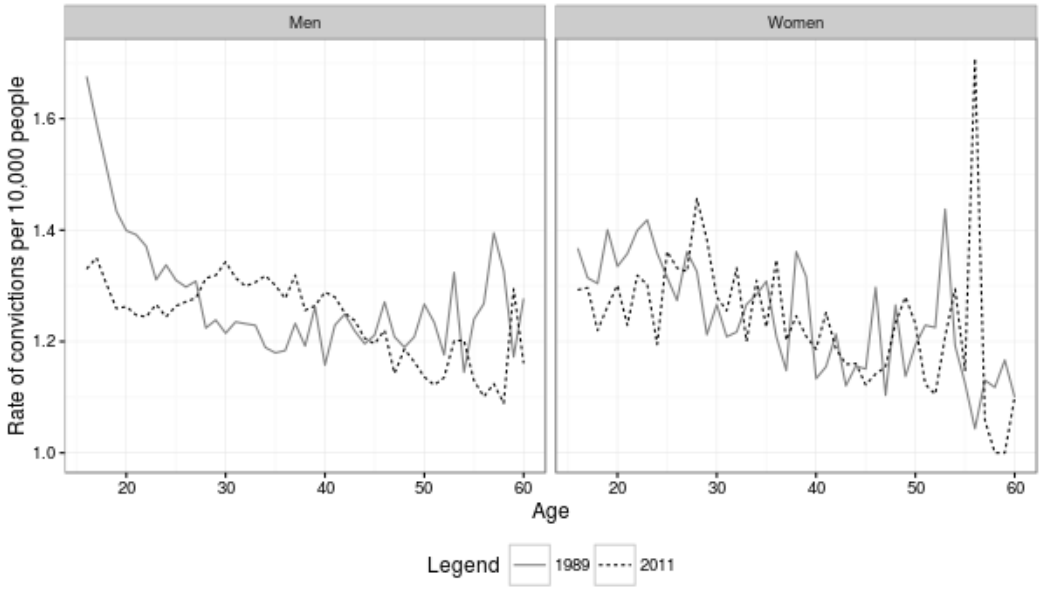

Figure 7.1 Comparison of the frequency of convicted offending, 1989-2011, ages 16-60

In contrast to this clear decline in the frequency of convicted offending for young men, Figure 7.1 shows much less change for women. In part this more mixed picture for women is likely due to higher volatility caused by the smaller numbers of women convicted, particularly at older ages. Unlike men, women in 1989 had no sharp spike in the frequency of convictions for those 20 or under. The convictions frequency for young women in 1989 was less than 1.4 per person convicted, declining to 1.2 by age 30. In 2011 the frequency for women aged 23 or under is lower than in 1989, closer

to 1.3 than 1.4. For ages 25 and above there is little clear change over time, with the age-specific frequency values in 2011 being much closer to their 1989 values than those for men.

Frequency of convicted offending: different crime types

To assess how these changes in the frequency of convicted offending observed in Figure 7.1 varied by crime types, Figures 7.2 and 7.3 compare the frequency of convicted offending for different crime types between 1989 and 2011 for men and women respectively. These figures are presented between the ages of 16 and 40 due to the high volatility in the frequency of conviction for older ages.

Starting with men, Figure 7.2 shows that the majority of change in frequency occurs for crimes of dishonesty. No other crime type has a frequency of conviction greater than 1.25 convicted offences per person convicted at any age, and for most crime types the frequency of conviction is lower than 1.1 for all ages. The crime type with the second highest frequency is breach of the peace, which shows a peak of 1.2 in 1989 at age 16, falling to around 1.12 in 2011. In contrast, the frequency of convicted offending for dishonesty for 16 year old men in 1989 is 1.6 convicted offences per person convicted. This declines sharply from age 16 to a rate of 1.2 at age 30 before declining more gradually to a frequency of 1.1 at age 40. By 2011, this declining trend over age was reversed. After initially declining from just under 1.3 at age 16 to 1.2 at age 19, the frequency of convicted offending for dishonesty increased rapidly to age 30, at which point the average number of convictions of dishonesty per person convicted of dishonesty was greater than 1.5. The frequency then declined from this peak to less than 1.35 by age 40, but this was still substantially higher than the equivalent value in 1989 (1.1). This pattern of difference between the two comparison years for crimes of dishonesty was markedly different than for any other crime type. The other types of crime showed very little difference in the profile of conviction frequency over time. Thus, the change in overall conviction frequency for men was driven predominately by change in the frequency of conviction for dishonesty.

Figure 7.3 shows frequency for different crime types in 1989 and 2011 for women. The category of all other crimes and offences shows a very different trend to the

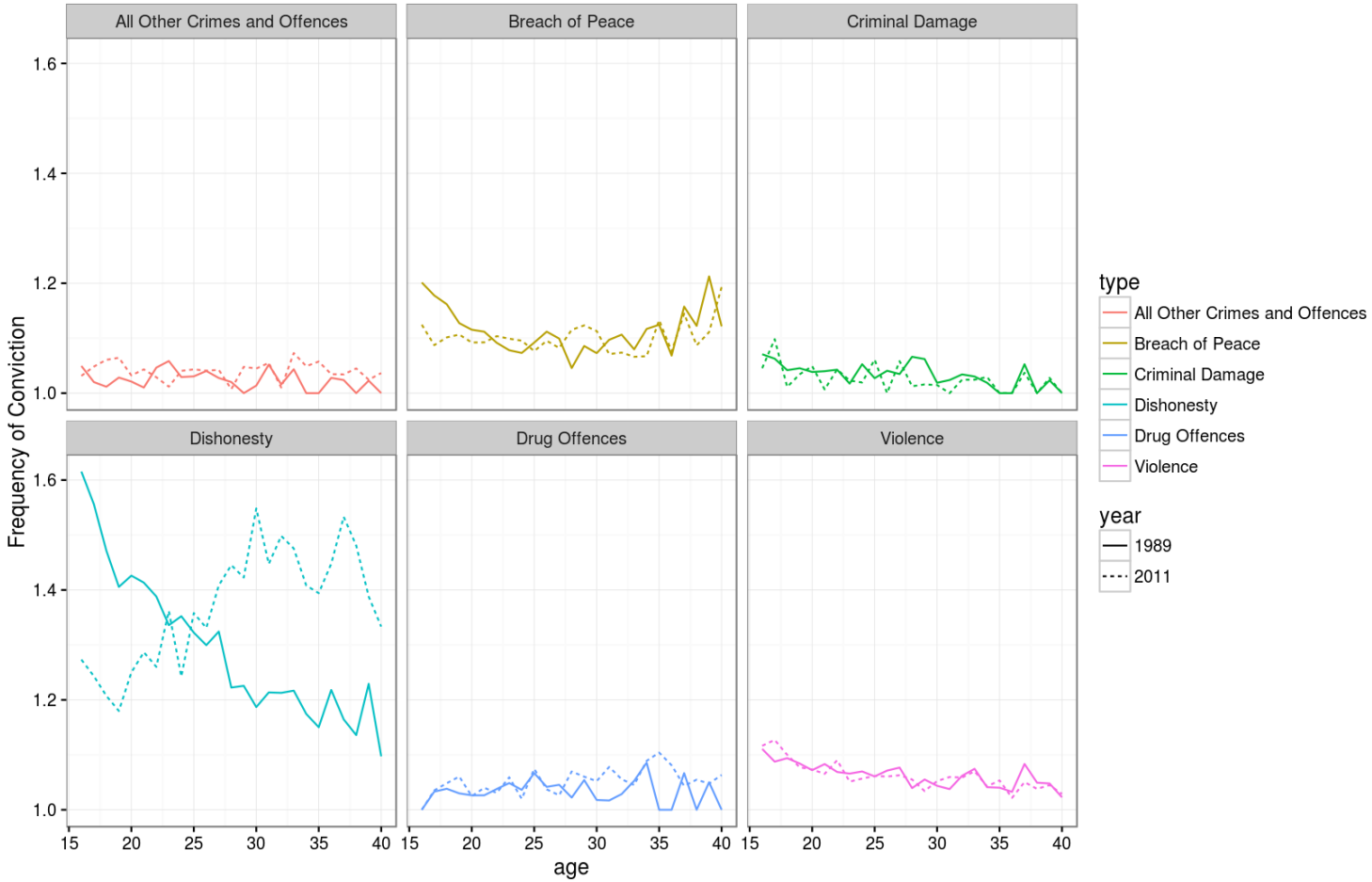

Figure 7.2: Frequency of conviction of different crime types in Scotland in 1989 and 2011, men

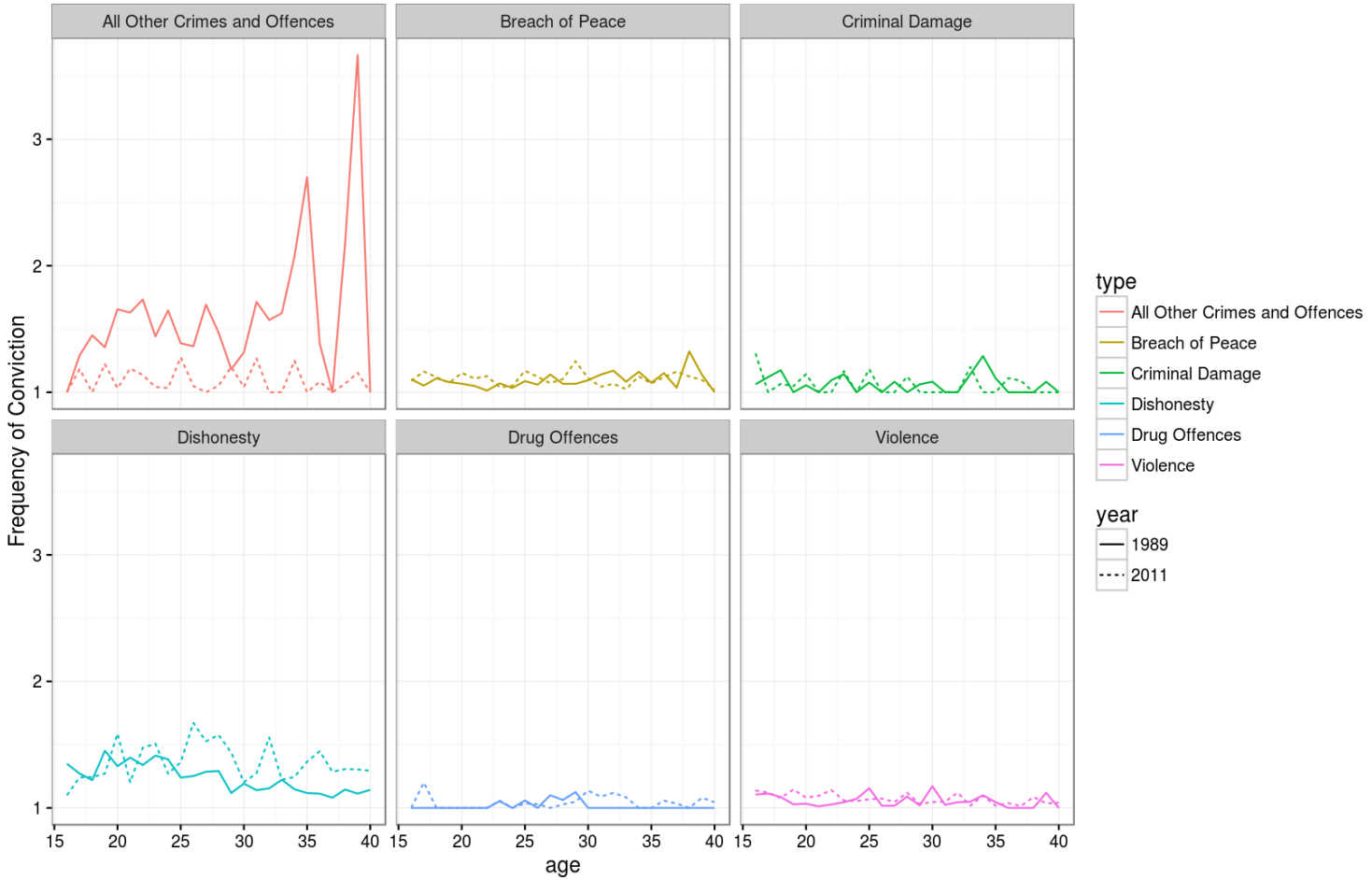

Figure 7.3: Frequency of conviction of different crime types in Scotland in 1989 and 2011, women

other crime types. Further analysis of this crime type (see Appendix 12) suggests that between 1989 and 2000 there was a very high frequency of convictions for women between age 20 and age 40 for offences relating to prostitution, which was driving these high frequency of convictions for all other crimes and offences. The frequency of conviction for prostitution offences declines sharply after 2000, and consequently so does the frequency of conviction for all other crimes and offences. Dishonesty shows a quite different trend for women compared to men. In 1989 the frequency of dishonesty for women peaked at 1.45 at age 19, then declined steadily to around 1.1 by age 40. However, in 2011, frequency increased, albeit unevenly, from 1.1 at age 16 to over 1.65 at age 26 before declining, again unevenly, to around 1.3 by age 40. The four other crime types show similar trends in frequency for women as with men, with very low frequencies across age. As before, because dishonesty is a more prevalence crime type than all other crimes and offences (see Chapter Six) the change in overall conviction frequency for women was driven predominately by change in the frequency of conviction for dishonesty.

Due to the low frequency for most crime types the rest of this chapter focuses on changes in the frequency of all convictions. When examining the frequency of conviction for all crime types it can be inferred that this primarily relates to crimes of dishonesty. As a result, examining frequency for all convictions primarily reflects change in the frequency of people receiving multiple convictions for dishonesty as well as people being receiving multiple convictions for different types of crime.

Annual change in the frequency of convicted offending

Figure 7.4 examines annual change in the frequency of convicted offending between 1989 and 2011 in a shaded contour plot. The plot shows that the change in frequency for men and women is not linear. From the red shading and contours labelled 1.7 in the plot for men, we can see that this drop in the frequency of convictions for young men only occurs after 1997. This plot also shows that increases in the frequency of convictions for those between the ages of 30 and 40, seen in Figure 7.1, only appear around 1995 at age 25 and then 2005 at age 30. The diagonal contour lines labelled 1.3 indicate that this trend may be a cohort effect. Figure 7.4 shows that for most of the period between 1989 and 2011 the frequency of convictions declined with age. The exception to this trend comes in the years after 2005 where the frequency of

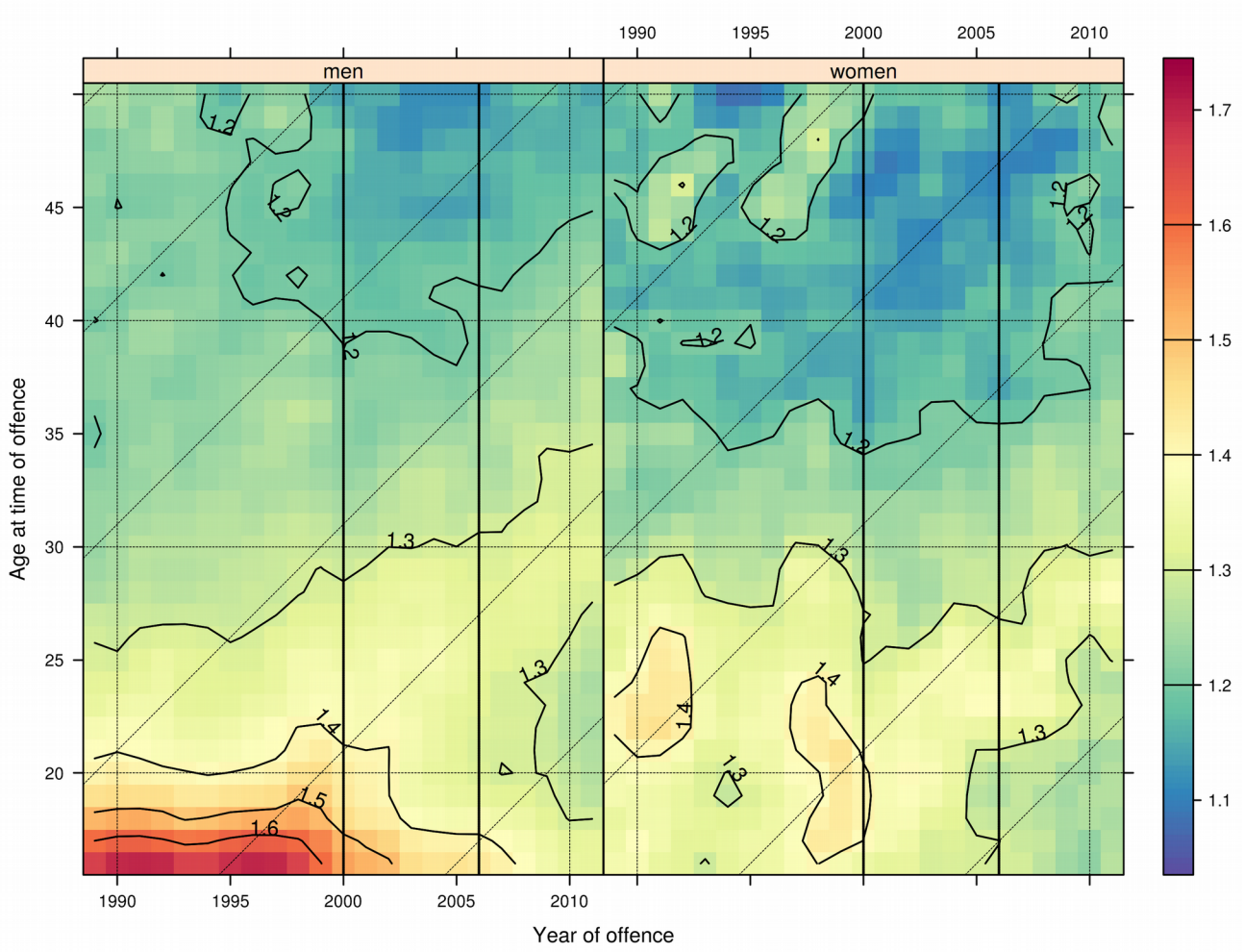

Figure 7.4: Shaded contour plot of the frequency of conviction of all crime types in Scotland 1989-2011

conviction is higher between 30 and 35 than it is for men aged 20-30.

For women, there is also a decline in frequency after for those between the ages of 20-25. Overall though, Figure 7.2 shows a less clear picture for women than it does for men. Whilst the frequency of convicted offending does show declines over age, seen in the yellow and orange shading for younger men and women moving to green shading for older women, this trends is less even for women than for men as shown by rougher surface of the contour plot and the number of contours marked 1.4 and 1.3. This is due to there being both less decline and more volatility in the frequency of conviction for women of different ages. There are no sustained peaks of frequency for teenage women as there are for teenage men, but there is a sustained decline in the frequency of conviction for young women, beginning around 2005. This is shown by the contour line labelled 1.3, which runs from age 16 in 2005 to age 30 in 2011.

Drawing these findings together, Figure 7.4 shows that the sharp decline in frequency seen for young men in Figure 7.1 occurs 2000, and the decline in frequency seen for young women in Figure 7.1 occurs 2005. Conversely, between the late 1990s and 2011 there are small increases in the frequency of convicted offending for men and women between age 30 and 40, particularly after 2005. These figures suggest that frequency will have some impact in reducing total rates of conviction rates from 2000 onwards, but that this trend will not be equal across age and not of a substantial magnitude.

Change in age structure

Having described changes in the frequency of convicted offending over the period covered by the SOI, focus now turns to examining change in age structure. Figure 7.5 shows a shaded contour plot of the numbers of men and women of different ages in Scotland between 1989 and 2011 for the ages 16 to 60.

There are strong cohort effects when analysing change in age-structure because "given only one alternative, people age one year per year" (Minton 2014:54, citing Vonnegut 2005). The only deviation from cohort effects comes from migration and mortality. Strong cohort effects are evident in Figure 7.5, from the very clear diagonal contours. This chart shows large cohorts of men and women between age

20 and 30 in 1989. These cohorts were born in the mid-to-late sixties – the children of the post-war baby boomers – and are indicated by the orange shading. These cohorts are of similar sizes (in numbers) for men and women, but comprise a slightly higher proportion of the male population than the female population. Following these baby boom cohorts were smaller 'baby bust' cohorts. Due to the ageing of the baby bust cohorts, and their replacement by cohort who continue to be smaller than the baby boom cohorts, the proportion of men and women between the ages of 20 and 30 is lower in 2011 than in 1989. This is shown by the warmer colours in the bottom-left of the two plots and the cooler colours in the bottom-right of the two plots. Consequently in the first five years covered by SOI we see substantial change in the proportion of the population comprised of young people, but after this point the proportion of teenagers in the population remain mostly stable. This is shown by the smaller number of contours in the bottom-right of the plot.

For cohorts born after 1980, there are increases in the proportion of the population aged 18 to 22 between the mid-2000s and 2011. These population increases, shown by the group of contours in the bottom-right of both plots (labelled 0.016 and 0.017 for men and labelled 0.015 for women), are due to migration in to Scotland during these ages and in particular due to students coming to Scotland to attend University and then moving out of Scotland after graduation (Scottish Government 2011:49). Whilst migration has increased the numbers of people between 18 and 23 in Scotland, these influences on overall population structure from migration are smaller than the impact of the baby boom and baby bust cohorts.

Based on these trends, the effect of changing age structure is likely to decrease total conviction rates. This is because in 1989 the large baby boom cohorts were in their twenties and thirties – ages typically with higher conviction rates than older ages. As these large cohorts were replaced by smaller baby bust cohorts the effect would be to reduce overall conviction rates, *ceteris paribus*. As there is less population change for young people after 2000, change in age structure will have less of an impact on convictions rates during this time. Using standardization and decomposition techniques, the next section formally compares the effects of changing age structure with the influence of prevalence and frequency in reducing total conviction rates.

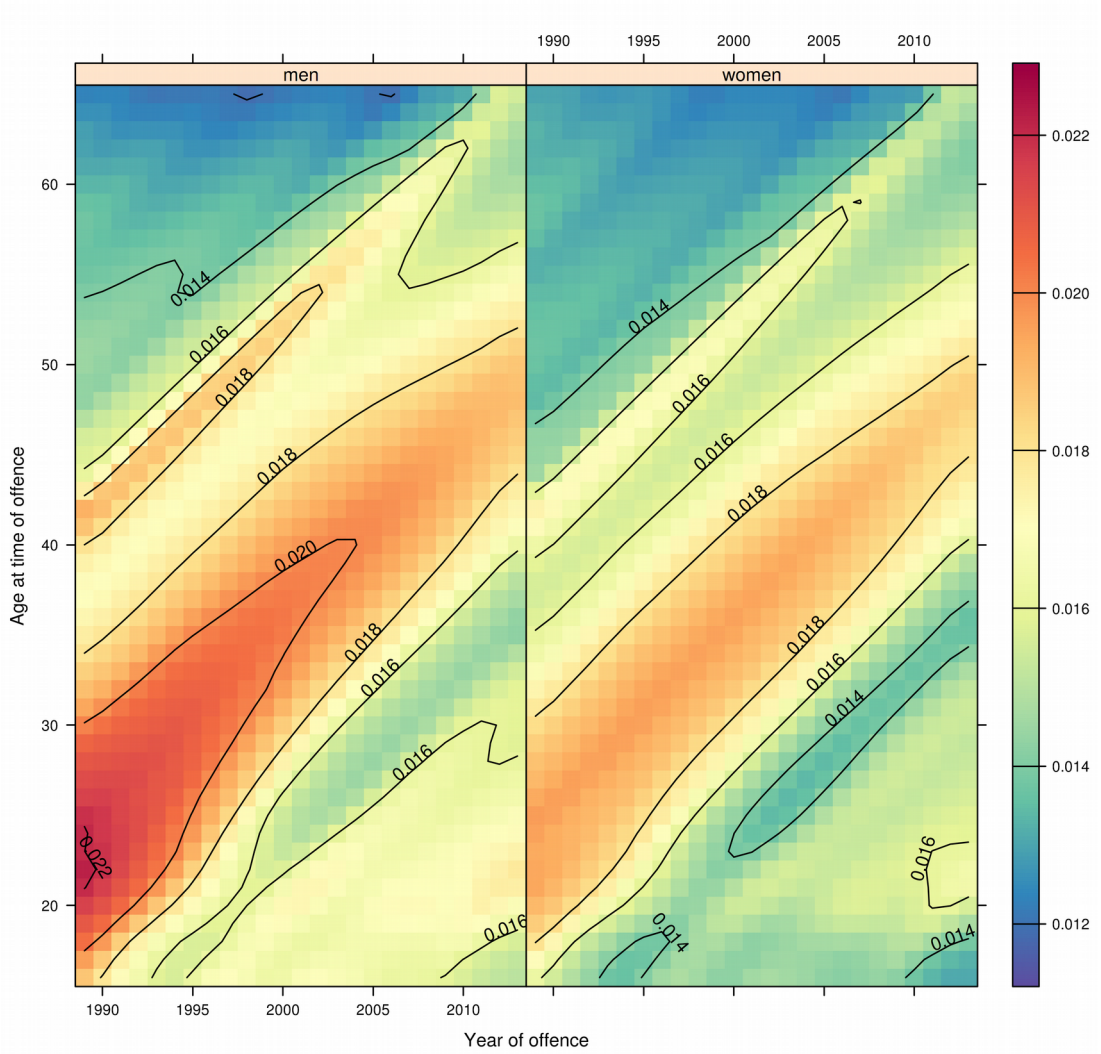

Figure 7.5 Shaded contour plot of age-structure change for men and women aged 16-60 in Scotland 1989-2011

7.3 Standardization and Decomposition of Convicted Offending Rates: 1989-2011

To compare the relative contributions of age-structure, prevalence and frequency to change in overall rates of convicted offending, this section presents the results of a standardization and decomposition analysis. First rates are compared between 1989 and 2011 and then for the three periods identified in Chapter Six as having distinct trends in the prevalence of conviction (1989-2000, 2000-2007 and 2007-2011). Rates are presented for convicted offences per 10,000 population, but it should be noted that rates have little intrinsic meaning and are best used only for comparison with rates compiled using the same process of standardization (Vogel and Porter, 2015:12). These results analyse the effects of age-structure (the proportion of people in a population of different ages) rather than population, thus controlling for change in population size[123]. In Tables 7.1 and 7.2, differences between years are calculated as the differences from 1989 to 2011. Consequently, negative figures show reductions in the conviction rates over time. Percentages show the contribution to the total amount of change regardless of the direction of change. Negative percentages show a a factor pulling in the opposite direction to the direction aggregate change; for example, if the contribution of change in age structure was to increase the standardized conviction rate during a period when the overall standardized conviction rate fell (due to a greater impact of prevalence and frequency acting in the opposite direction), the percentage contribution of age structure would be shown as negative.

Comparing 1989 and 2011: men

Table 7.1 shows change in conviction rates for men standardized by prevalence and frequency ($\beta\gamma$), age-structure and frequency ($\alpha\gamma$) and age-structure and prevalence ($\alpha\beta$) split into an age component, a prevalence component and a frequency component using the equations described in Section 5.3. In Table 7.1 the standardization column shows total convicted offending rates for 1989 and 2011 standardized by the average prevalence and frequency between 1989 and 2011 ($\beta\gamma$),

123 Appendix Six shows figures which standardize by population size. The results from these two analyses are similar, but with those standardized by the numbers of people of different ages showing an increased impact of change in prevalence and frequency compared to change in age. This is because the total population of Scotland aged 16-90 has increased between 1989 and 2011 and so reductions in conviction due to change in age-structure are somewhat counterbalanced by increases in total population size leading to more convictions.

by age-structure and frequency ($\alpha\gamma$), and by age-structure and prevalence ($\alpha\beta$), as well as the actual (unadjusted) convicted offending rates for 1989 and 2011. The difference between these standardized rates is presented in the decomposition columns. The Difference (Effects) column subtracts the 1989 standardized convicted offending rate from the 2011 rate for to give the impact of age-structure (α), prevalence (β) and frequency (γ) on change in convicted offending rates between 1989 and 2011). These figures represent differences in overall convicted offending rates per 10,000 attributable to age-structure, prevalence and frequency, and the sum of these effects matches the difference in unadjusted convicted offending rates, confirmed by the bottom row of the table which shows the differences in crude rates with the sum of the contributions from age-structure, prevalence and frequency. If the decomposition has been calculated correctly, these two figures will be equal. The Percentage distribution of effects column shows these different effects as a percentage of overall change in conviction rates between 1989 and 2011.

Table 7.1 shows a fall in conviction rates per 10,000 between 1989 and 2011 when standardized by each combination of prevalence, frequency and age-structure. Consequently, each of these three factors has contributed to the decline in overall convicted offending rates. The Decomposition column shows that age-structure contributed a decline of 52 convicted offences per 10,000 people, prevalence a decline of 77 convicted offences and frequency a drop of 15 convicted offences. Prevalence contributed just over half of the total decline in convicted offending rates, age-structure just over one third and frequency around one tenth. However, these effects represent the cumulative impact of these three factors for all age groups, and so do not account for differences in these effects across age.

To examine differential effects of age-structure, prevalence and frequency across age, Figure 7.6 plots the age-specific contributions of these factors to the aggregate change in convicted offending rate shown in Table 7.1. Age is shown on the x-axis, with the contribution to the aggregate convicted offending rate on the y-axis. The solid black line shows age, the dashed line shows prevalence and the dotted line shows frequency. Similar to the results seen in Chapter Six, this figure shows a large discrepancy over age in the impact of these three factors on convicted offending rates.

Table 7.1. Standardization and Decomposition of convicted offending rates by age, prevalence and frequency, men 1989-2011.					
Convicted offending rates	Standardization		Decomposition		
	1989	2011	Difference (Effects)		% distribution of effects
Prevalence-frequency (βγ) standardized rates	322.21	269.79	Age (α)	-52.42	36.15
Age-frequency (αγ) standardized rates	333.68	256.38	Prevalence (β)	-77.30	53.30
Age-prevalence (αβ) standardized rates	304.05	288.75	Frequency (γ)	-15.30	10.55
Unadjusted convicted offending rates	376.69	231.67			
Difference in crude rates	-145.02		Total	-145.02	100
Source: Conviction data from SOI, population data from National Records of Scotland (2014). Figures to 2dp. Rates are per 10,000 population.					

Given the typical shape of the age-crime curve it is unsurprising that most of the impact of change in convicted offending is for those in their teens and early twenties, and Figure 7.6 displays a large impact of declining prevalence of convicted offending for men under the age of 22 leading to lower overall convicted offending rates. Prevalence still acts to reduce overall convicted offending rates up to age 28, although the contribution declines rapidly with age. However, for those aged between 29 and 45 changes in prevalence have contributed modest *increases* to overall rates of convicted offending. This reflects the change in the age-crime curve described in Chapter Six, with declining prevalence for young men and increases in prevalence for older men. Whilst the magnitude of change is smaller, frequency has also contributed to declines in convicted offending rates until age 27, at which point the impact of frequency is to increase overall convicted offending rates until around age 40. This is in line with the changes in the frequency of convicted offending described in section 7.1. Age structure has a consistent effect in lowering convicted offending rates until age 42, whilst between age 42 and 55 age structure contributes slight increases to overall convicted offending rates. This is the impact of the ageing baby-boom cohort being replaced by smaller baby-bust cohorts seen in Figure 7.5.

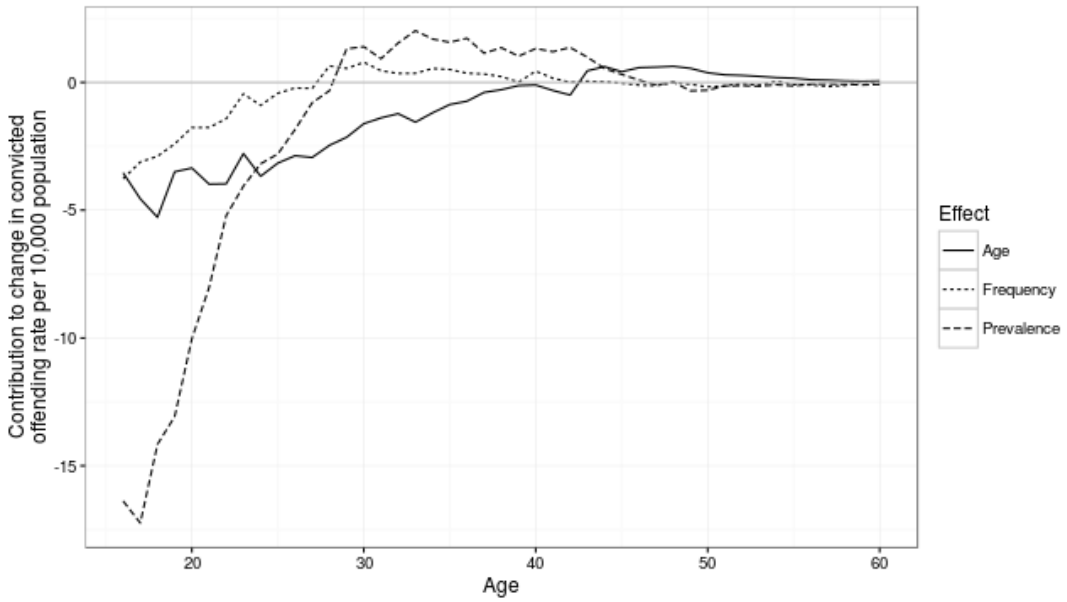

Figure 7.6 Contributions of age structure, prevalence and frequency to the aggregate convicted offending rate 1989-2011, men

Together the trends shown in Figure 7.6 emphasise that there have been different trends across age in the impact of prevalence, frequency and age-structure. Lower prevalence and frequency for young men, as well as young men making up a smaller proportion of the population, work together to drive down aggregate convicted offending rates. The impact of prevalence, frequency and age structure in reducing conviction rates for young men is sufficiently large to outweigh increases in prevalence and frequency for those from their late twenties to early forties. Figure 7.6 also shows that increases in prevalence and frequency for those age 25-40 are to some extent counteracted by demographic change, with there being a smaller proportion of the population of men aged 25-40 in 2011 compared to 2011. The baby bust both magnified declining convicted offending rates for young men and also suppressed increases in conviction rates for men in their late twenties and thirties. In other words, falling conviction for men between 1989 and 2011 are due to the effects changing age-structure and lower prevalence and frequency for young men. The effects of prevalence and frequency for men aged 25-40 actually contribute increases to conviction rates during this period.

Comparing 1989 and 2011: women

Table 7.2 presents the standardization and decomposition of convicted offending rates by age structure, prevalence and frequency for women between 1989 and 2011. This table is presented in the same format as Table 7.1. As would be anticipated, the convicted offending rates in 1989 and 2011 are much lower for women than men (unadjusted rates of 46.74 and 40.04 for women compared to 376.69 and 231.67 for men). The aggregate decline between 1989 and 2011 is commensurately lower (a drop of 6.70 convictions per 10,000 for women compared to a fall of 145.02 convicted offences for men). Of this overall change, the substantial majority comes from changes in age structure, which provides almost 80% of the overall decline in standardized rates of convicted offending between 1989 and 2011. In contrast, prevalence and frequency each contribute only around 10% of this change. Compared to the results for men, change in the age structure of the population has played a much greater role for women in reducing overall rates of convicted offending between 1989 and 2011. In contrast, changes in the prevalence of convictions much less important for women than men. For women, prevalence has almost exactly the same contribution to the fall in conviction rates as frequency. but for men prevalence has around five times as large an impact in reducing conviction rates than frequency. These results are in accordance with the greater fall in prevalence seen for men in Chapter Six, and emphasise that there are substantial differences between men and women in the impact of prevalence, frequency and age-structure on conviction rates.

Table 7.2. Standardization and Decomposition of convicted offending rates by age, prevalence and frequency, women 1989-2011.

Convicted offending rates	Standardization		Decomposition		
	1989	2011	Difference (Effects)		% distribution of effects
Prevalence-frequency (βγ) standardized rates	45.75	40.46	Age (α)	-5.29	78.93
Age-frequency (αγ) standardized rates	43.43	42.72	Prevalence (β)	-0.70	10.46
Age-prevalence (αβ) standardized rates	43.48	42.77	Frequency (γ)	-0.71	10.61
Unadjusted convicted offending rates	46.74	40.04			
Difference in crude rates	-6.70		Total	-6.70	100

Source: Conviction data from SOI, population data from National Records of Scotland (2014). Figures to 2dp. Rates are per 10,000 population.

Figure 7.7 presents the age-specific contributions of age-structure, prevalence and frequency to the overall change in convicted offending rates for women in Table 7.2. As with men, changes in population structure led to declines in convicted offending rates between the ages of 16 and 38 and much smaller increases in conviction rates between the ages of 38 and 55. Again, this reflects the replacement of the large baby-boom cohort with smaller baby bust cohorts. Prevalence contributes to a decline in convictions from ages 16 to 25 to a greater extent than age-structure, but this decline in prevalence for young women is counteracted by *increases* in prevalence from age 25 to 55, particularly through the late twenties and thirties. For women there is a similar pattern of variation over age in the effects of prevalence as seen for men, with prevalence declining for young women and increasing during the twenties and thirties. Unlike with men, falls in the prevalence of convicted offending for young women do not outweigh these increases in prevalence for older women, leading to the small overall effect of prevalence for women seen in Table 7.2.

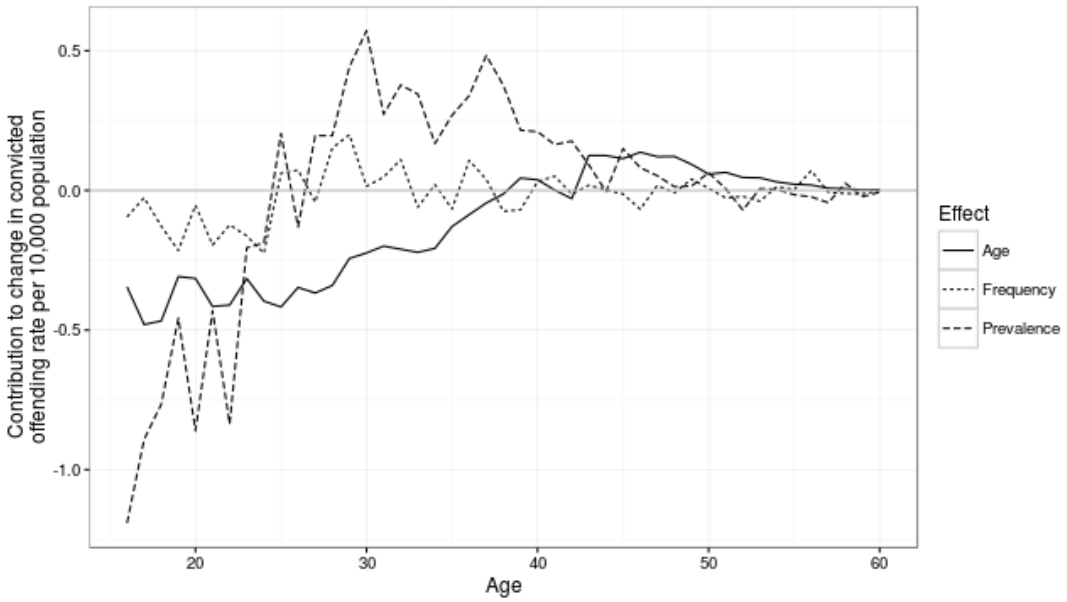

Figure 7.7 Contributions of age structure, prevalence and frequency to the aggregate convicted offending rate 1989-2011, women

There are only small contributions of frequency in reducing standardized convictions rates, predominately for women aged 23 and under. Despite prevalence and frequency having similar contributions to aggregate convicted offending rates, for frequency this is due to very small amounts of change overall, whilst for

prevalence this is due to relatively large declines in prevalence for those in the teens and early twenties being counteracted by increases in the prevalence of convicted offending for those in their late-twenties to late-forties. Whilst the net impact of these two factors is similar, for women there is much more variation over age in the impact of prevalence than frequency.

The anatomy of the crime drop: Comparison with existing research

The results presented so far provide an important insight into change in convictions patterns over the period of the crime drop in Scotland. The results in Tables 7.1 and 7.2 and Figures 7.6 and 7.7 demonstrate that prevalence has played a greater role in leading to declines in convicted offending rather than frequency, although this effect is much more pronounced for men than women in this analysis. That prevalence has a greater effect than frequency is in accord with Farrington's (1986) assertion that the aggregate age-crime curve is primarily a function of prevalence rather than frequency (see also Farrell et al. 2015:4). There are similarities between these results and those of Berg et al. (2016), who note the importance of declines in prevalence for violence and both prevalence and frequency for property crimes. However the results here are a helpful complement to those of Berg et al. (2016), adding important nuance to their results. In particular, the results presented so far contribute three important points to the existing literature.

First, the findings presented so far show a marked difference in the role of prevalence and frequency across sex. This questions whether the findings of Berg et al. (2016), who focus exclusively on a male cohort, are applicable to young women and emphasises the differences in conviction trends across sex described in Chapter Six. Second, these results show contrasting trends over age in prevalence and frequency, with those between the ages of 25 and 40 having very different trends to younger men and women. These discrepancies over age suggest that a focus on analysing change in prevalence and frequency for a small age range – even one which has historically provided a disproportionately large contribution to offending rates – as in Berg et al. (2016) may not tell the full story of how prevalence and frequency have changed over the course of the crime drop. Indeed, the results presented here question the value of providing a singular answer to the question of how prevalence and frequency have changed over the course of the crime drop.

Third, the results presented so far indicate that a full account of the 'anatomy' of the crime drop must include age-structure as well as prevalence and frequency as this factor has also contributed to reductions in conviction rates. Given the data used by Berg et al. (2016)[124], it would have been infeasible to include age-structure as part of their analysis. Being able to account for population change is a benefit of using SOI data to explore this problem, and of the research design adopted here.

It should be noted that comparing these results with those of Berg et al. (2016) must be done with care as their analysis had different aims from those presented here. Berg et al. (2016) used a regression approach to estimate change in prevalence and frequency between two cohorts and whether that change was statistically significant. In contrast the approach adopted here aimed to separate out the decline in convicted offending rates that has been observed into three distinct components, including prevalence and frequency; even if, as was the case for women, there was little overall change. Moreover, the focus of Berg et al.'s (2016) analysis on self-reported offending is another point of difference with the results presented here. Given that SOI obeys the principal offence rule (Aebi and Linde, 2012) and so multiple offences are covered by single convictions, it is likely that the figures presented here would substantially underestimate the frequency of *offending* behaviour. Whilst any differences in trends between men and women and across age are not affected by this, and likewise the comparison between age structure and conviction rates, this may explain the greater importance of frequency as seen in Berg et al.'s (2016) results. Berg et al.'s (2016) analysis showed a decrease in property crimes of 47% due to frequency, as opposed to the findings presented here which show that frequency contributed around 10% of overall declines in convicted offending for both men and women.

Similar to Chapter Six, analysis of the contributions of prevalence, frequency and age-structure between 1989-2011 has shown important differences across age and sex. Drawing on another finding from Chapter Six, the analysis now focuses on the differing effects of these three factors over time.

124 That is, self-report data over two cohorts which represent a small sample of young men in a particular city (Berg et al. 2016).

7.4 Standardization and Decomposition: Comparing 1989-2000, 2000-2007 and 2007-2011

To account for potential differences across time, standardization and decomposition analysis are conducted for the three periods identified in Chapter Six. The table is arranged in the same format as Table 7.1 and 7.2, but divided into vertically into three sections, which present standardization and decomposition analyses for 1989-2000, 2000-2007 and 2007-2011 respectively. As a result, change over time in the effects of prevalence, frequency and age structure can be seen by making comparisons between these three sections.

Men

Table 7.3 shows that the effects of prevalence, frequency and age-structure differ substantially over the three periods analysed. Prevalence has played a much greater role in reducing convictions rates than frequency overall, but between 2000 and 2007 the impact of prevalence was to increase standardized rates of convicted offending whilst frequency continued to reduce overall convicted offending rates. Age structure has had a consistent effect in lowering standardized convictions rates for men, but its largest impact was between 1989 and 2000. The results for each of these three periods are discussed in turn.

The period between 1989-2000 shows similar patterns to overall change in age-structure, prevalence and frequency. Each of these three components led to declines in the overall conviction rate, with prevalence showing the largest impact (around 56%) followed by age-structure (42%), with frequency contributing a very small amount of change (2%). Of the three periods, 1989-2000 showed the largest change in the overall conviction rate for men, with a decline of just fewer than 119 convicted offences per 10,000 population. It is worth noting though that this period also covers the longest time span, which provides more opportunity for convicted offending rates to change.

In marked contrast, from 2000 to 2007 there are overall *increases* in the rate of convicted offending by around 17 convicted offences per 10,000 people. During this period the effect of prevalence and the effects of age-structure and frequency pull in opposite directions, with age-structure and frequency both *lowering* overall rates of

Table 7.3. Standardization and Decomposition of convicted offending rates by age, prevalence and frequency, men 1989-2000, 2000-2007, 2007-2011.

Convicted offending rates	Standardization		Decomposition		
	Year		Difference (Effects)		% distribution of effects
Period One					
	1989	2000			
Prevalence-frequency (βγ) standardized rates	339.16	289.22	Age (α)	-49.94	42.02
Age-frequency (αγ) standardized rates	347.30	280.78	Prevalence (β)	-66.52	55.97
Age-prevalence (αβ) standardized rates	316.18	313.80	Frequency (γ)	-2.38	2.01
Unadjusted convicted offending rates	376.69	257.84			
Difference in crude rates	*-118.84*		*Total*	*-118.84*	*100*
Period Two					
	2000	2007			
Prevalence-frequency (βγ) standardized rates	271.28	262.83	Age (α)	-8.45	-49.98
Age-frequency (αγ) standardized rates	249.91	284.09	Prevalence (β)	34.18	202.15
Age-prevalence (αβ) standardized rates	271.21	262.39	Frequency (γ)	-8.82	-52.18
Unadjusted convicted offending rates	257.84	274.75			
Difference in crude rates	*16.91*		*Total*	*16.91*	*100*
Period Three					
	2007	2011			
Prevalence-frequency (βγ) standardized rates	254.71	251.23	Age (α)	-3.48	8.07
Age-frequency (αγ) standardized rates	272.15	233.48	Prevalence (β)	-38.67	89.75
Age-prevalence (αβ) standardized rates	253.30	252.36	Frequency (γ)	-0.94	2.18
Unadjusted convicted offending rates	274.75	231.67			
Difference in crude rates	*-43.09*		*Total*	*-43.09*	*100*

Source: Conviction data from SOI, population data from National Records of Scotland (2014). Figures to 2dp. Rates are per 10,000 population.

convicted offending, whilst prevalence acts to increase total convicted offending rates. As a result, the effect of prevalence contributes more than 200% of the increase in total convicted offending rates. Not only are increases in convictions exclusively due to prevalence, the convicted offending rate during this period would be twice as large as that which was actually observed if age-structure and frequency had not served to counteract increases in prevalence.

In the final period from 2007-2011, age-structure, prevalence and frequency all contribute to declines in the total rate of convicted offending, as in the period 1989-2000. However, unlike in this first period the substantial majority – almost 90% – of this decline comes from changes in prevalence. Age-structure contributes just over 8% to this decrease, with frequency providing a decline in total convicted offending rates of just over 2%. Whilst age-structure contributed over 40% of the drop in convicted offending rates between 1989 and 2000, its contribution between 2007 and 2011 is just over 8%. This shorter period also help to explain the lesser contribution of age-structure to convicted offending rates during these periods, which are gradual (Zimring 2007) and so have less opportunity to show substantial change across shorter time periods. It should also be noted that whilst the overall amount of change in this period is smaller than between 1989-2000, showing a decline of 43 convicted offences per 10,000 people, this period is also much shorter (four years compared to eleven years). As such, the average rate of change between the two periods is similar (an average decline of 10.80 convicted offences per year between 1989 and 2000 compared to an average decline of 10.77 convicted offences per year between 2007 and 2011).

Table 7.3, then, shows very different trends in each of the three periods analysed, which are obscured by only examining aggregate change between 1989 and 2011. As with Tables 7.1 and 7.2, figures in Table 7.3 represent population totals. Figure 7.8 presents the age-specific contributions to the standardization and decomposition analysis discussed in Table 7.3. The top-left panel is a replication of Figure 7.6, which shows the age-specific contribution to the decomposition between and 1989-2011. The top-right panel shows the standardization and decomposition between 1989 and 2000, the bottom-left panel that for 2000-2007 and the bottom-right panel the results for 2007-2011. Including the results for 1989-2011 alongside the

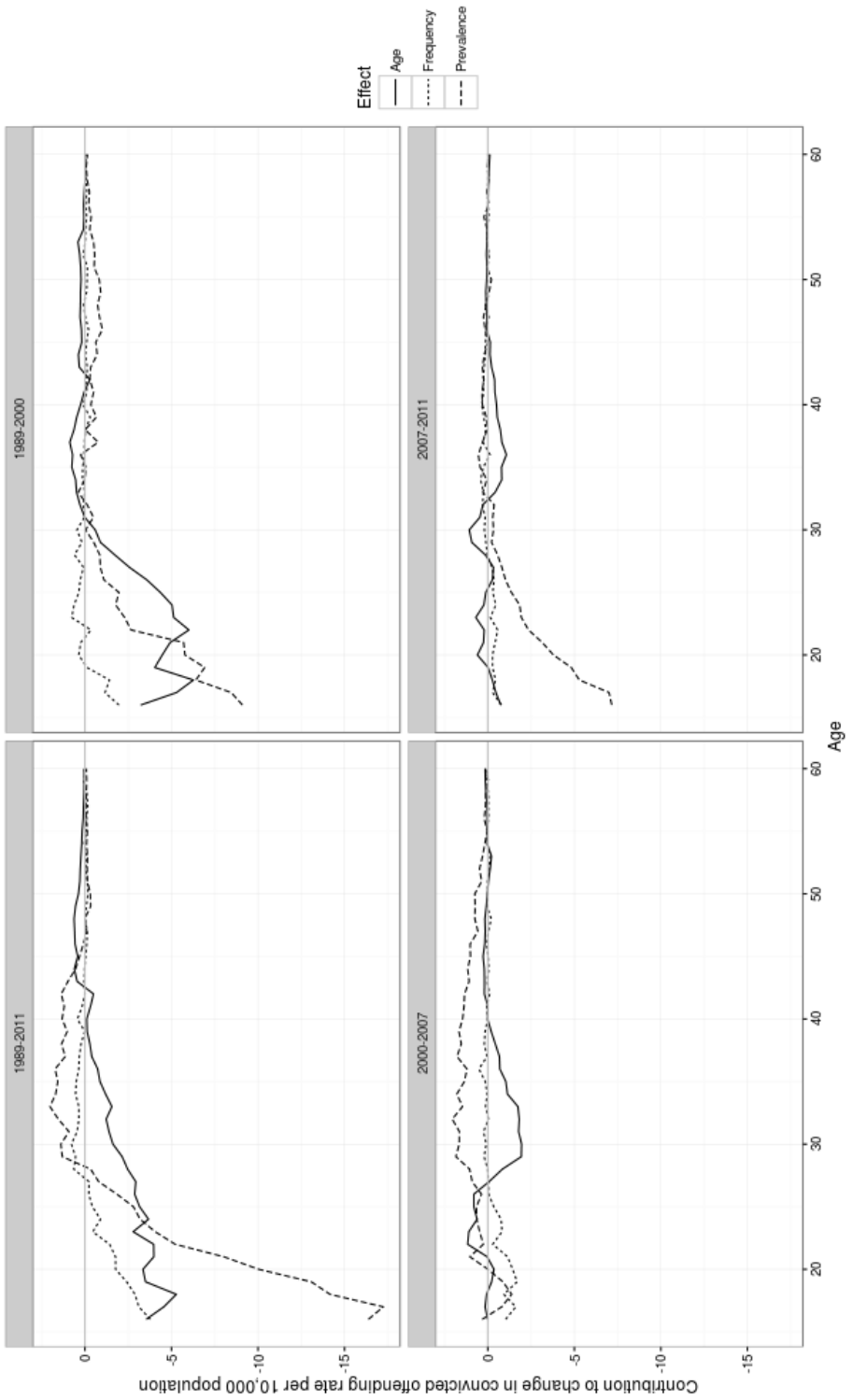

Figure 7.8 Contributions of age structure, prevalence and frequency to the aggregate convicted offending rate 1989-2011, 1989-2000, 2000-2007, 2007-2011 men (Note: panel 1989-2011 same as Figure 7.6)

analyses for different periods helps to compare the change within each of the three periods to the overall pattern of change between 1989 and 2011.

Unsurprisingly, Figure 7.8 shows that the majority of the contribution of age-structure occurred between the ages of 16 and 30 from 1989 to 2000, as the baby boom cohort was replaced by smaller baby bust cohorts. As expected from Chapter Six, this period also shows declining prevalence of convicted offending rates for men under age 30, with no increases in prevalence for older ages. Frequency shows a very small impact in reducing convicted offences for men under the age of 20 between 1989 and 2000, and some slight increases for those in their mid-twenties, but little overall change.

The second period from 2000 to 2007 presents a very different picture. The increases in prevalence for those between their mid-twenties and forties seen in Chapter Six occur entirely between 2000 and 2007, and these ages contribute to increases in overall convicted offending rates. In contrast, the frequency of conviction *decreases* during this period for those aged under 25, and this is also the period with the greatest decrease in convicted offending rates due to age structure between 27 and 40, as the smaller baby-bust cohorts move through these ages.

Between 2007 and 2011 we see a similar magnitude of declines in prevalence for young men as between 1989-2000. However, there is little change in frequency during this period, and there is almost no effect of population structure reducing conviction rates for young men. Instead, during this period the baby-bust cohorts are between their early thirties and mid-forties. Whilst changes in age-structure due to the replacement of baby boom cohort with baby bust cohorts does contribute to lower convicted offending rates, this effect is much smaller than the effect of the same baby bust cohorts replacing the baby boom cohorts in the 1990s, due to the lower prevalence of conviction for men in their thirties compared to men in their twenties.

The results presented in Figure 7.8 show very different trends in the relationship between prevalence, frequency and age-structure for men of different ages in different periods. Of these three factors, prevalence has had the greatest effect in

both decreasing and increasing conviction rates across all three periods. The effects of age-structure are concentrated between 1989-2000 as baby boom cohorts in their early twenties were replaced by baby bust cohorts. The effect of frequency was consistently much smaller than that of prevalence over all three periods.

Women

Table 7.4 presents the standardization and decomposition results for women between 1989-2000, 2000-2007 and 2007-2011 in the same format as Table 7.3. Again, this analysis shows very different trends in the impact of prevalence, frequency and age-structure in different periods.

As with men, the first period (1989-2000) shows very similar results to those presented in Table 7.2 for the whole of the SOI (1989-2011). During this time the convicted offending rate fell by just over six convicted offences per 10,000 people, with almost 80% of this decline being attributable to change in age-structure. Prevalence and frequency both also show declines over this period, contributing just over 8% and 12% of change respectively.

In contrast, and as with men, the period 2000-2007 had an average increase in total rate of convicted offending by 7.9 convicted offences per 10,000. In fact, the convicted offending rate in 2000 was higher than it was 1989. This change is entirely attributable to increases in the prevalence of conviction, which contributed an increase of 9.5 convicted offences per 10,000 population. Whilst prevalence served to increase convicted offending rates, age-structure and frequency both decreased convicted offending during this period by 1.22 and 0.42 convicted offences per 10,000 respectively. As with men, the effects of prevalence pulled in the opposite direction to the effects of age-structure and frequency during this period.

In the final period between 2007 and 2011 the total rate of convicted offending shows the greatest amount of change for any of the three periods, falling by 8.49 convicted offences per 10,000. This drop is overwhelmingly due to falls in the prevalence of convicted offending, with age-structure also providing small declines in the total convicted offending rate during this period. In contrast, frequency led to an increase in convicted offending between 2007 and 2011 of 0.76 convicted offences

per 10,000.

Table 7.4. Standardization and Decomposition of convicted offending rates by age, prevalence and frequency, women 1989-2000, 2000-2007, 2007-2011.					
Convicted offending rates	Standardization		Decomposition		
	Year		Difference (Effects)		% distribution of effects
Period One					
	1989	2000			
Prevalence-frequency (βγ) standardized rates	46.22	41.38	Age (α)	-4.84	79.27
Age-frequency (αγ) standardized rates	44.04	43.53	Prevalence (β)	-0.52	8.48
Age-prevalence (αβ) standardized rates	44.13	43.39	Frequency (γ)	-0.75	12.24
Unadjusted convicted offending rates	46.74	40.63			
Difference in crude rates	*-6.11*		*Total*	-6.11	100
Period Two					
	2000	2007			
Prevalence-frequency (βγ) standardized rates	45.28	44.06	Age (α)	-1.22	-15.46
Age-frequency (αγ) standardized rates	39.88	49.41	Prevalence (β)	9.54	120.78
Age-prevalence (αβ) standardized rates	44.82	44.40	Frequency (γ)	-0.42	-5.32
Unadjusted convicted offending rates	40.63	48.53			
Difference in crude rates	*7.90*		*Total*	7.90	100
Period Three					
	2007	2011			
Prevalence-frequency (βγ) standardized rates	44.50	44.04	Age (α)	-0.45	5.35
Age-frequency (αγ) standardized rates	48.66	39.86	Prevalence (β)	-8.80	103.64
Age-prevalence (αβ) standardized rates	43.89	44.65	Frequency (γ)	0.76	-8.99
Unadjusted convicted offending rates	48.53	40.04			
Difference in crude rates	*-8.49*		*Total*	-8.49	100
Source: Conviction data from SOI, population data from National Records of Scotland (2014). Figures to 2dp. Rates are per 10,000 population.					

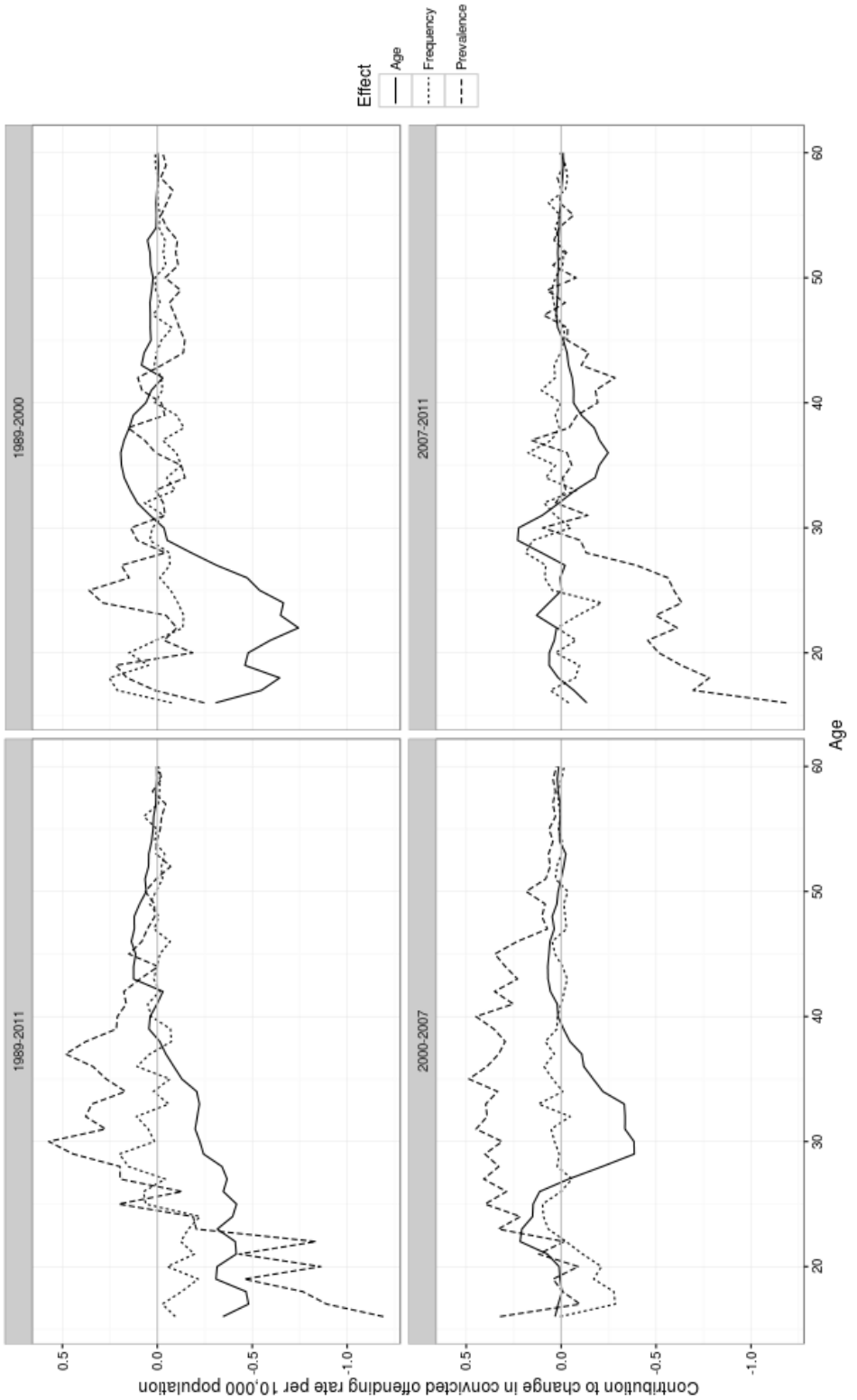

Figure 7.9 Contributions of age structure, prevalence and frequency to the aggregate convicted offending rate 1989-2011, 1989-2000, 2000-2007, 2007-2011 women (Note: panel 1989-2011 same as Figure 7.7)

These results show that change in age structure has consistently led to lower rates of convicted offending for women, but the impact of prevalence has been much more varied. Prevalence playing little role in reducing convicted offending rates for women between 1989 and 2000, contributed a large increase to overall convicted offending rates between 2000 and 2007 and then provided an almost equivalent decrease in convicted offending rates from 2007 to 2011. As with men, frequency had the smallest impact of the three factors analysed.

Figure 7.9 shows the age-specific contributions of age structure, prevalence and frequency to the overall convicted offending rate for women in the same format as Figure 7.7. As seen in Figure 7.8, Figure 7.9 shows substantial differences between the different periods analysed in the contributions of demographic change, prevalence and frequency across age. During the period 1989-2000 there was little systematic contribution to standardized conviction rates from change in age-specific rates of prevalence or frequency. In contrast, age-structure led to declining convictions between ages 16 to 30 due to there being fewer young people in the population, and also increases in conviction rates due to there being a larger proportion of women in their thirties between 1989 and 2000.

As the baby-bust cohorts aged, there were falls in conviction rates for women aged 26 to 40 between 2000 to 2007. This period also shows prevalence increasing conviction rates between the ages of 23 and 45, with the majority of the overall increase in prevalence for those aged 23 to 45 between 1989 and 2011 (Figure 7.7) coming in this period. In contrast, there is very little change in prevalence for women age 17 to 22 during this period. As with men, the impact of these changes in prevalence are to some extent suppressed by change in population structure, with this period of higher convicted offending rates spanning the cohorts of the baby bust, but increases in prevalence are also seen for the cohorts of the baby boom and cohorts of slightly larger size which followed the baby bust (see Figure 7.3). During this period frequency of convicted offending drops between ages 17 and 22, but shows little change across the rest of the age-distribution.

Finally, the period between 2007 and 2011 shows sharp declines in prevalence between age 16 and 28, especially for those aged 20 and under, and small declines

between age 40 and 45. This period shows almost the entirety of the decline in prevalence for young women seen between 1989 and 2011, as can be seen by the similar magnitude of negative contribution to overall convicted offending rates for women under age 23 in the 1989-2011 and 2007-2011 panels. Age structure has much less impact in this period, with the exception of small declines due to the baby bust cohorts who were in their mid-thirties during this period. The small increases due to frequency during this period predominately occur between age 25 to 30 and 34 to 38, with little clear pattern.

These results show substantial variation over time in the impact that prevalence, frequency and age-structure have had in reducing and increasing conviction rates for women. To help make comparisons between men and women more explicit, the following section compares the relative contribution of these three factors for men and women.

Comparison of trends between men and women

The results presented so far have shown complex patterns of change over time in the contributions of age-structure, prevalence and frequency to falling aggregate conviction rates for men and women. Given the substantial difference in rates of convicted offending between men and women these results can be difficult to directly compare across sex.

To make more obvious differences in trends between men and women, Table 7.5 shows change attributable to age-structure, prevalence and frequency for men and women as a percentage of the 1989 convicted offending rates for men and women respectively. Comparing the contributions of these three factors between men and women over time shows similar directions of effects but with differences in magnitude of the effect of prevalence. From 1989 to 2000 prevalence played a much larger role in decreasing the convicted offending rate for men than it did for women (17.66% compared to 1.11%). Between 2000 and 2007, prevalence increased for men and women, but the relative contribution of prevalence for women was more than twice as large as that for men (20.41% compared to 9.07%). In the final period prevalence led to falls in the total convicted offending rate for both men and women, but with the effect for women being more than to 80% larger than that for men

(18.83% compared to 10.27%). With the exception of the period between 2007 and 2011, women consistently show lower declines and greater increases in the rate of convicted offending than men, and in particular due to prevalence. These different trends for men and women emphasise the point made in Chapter Six that conceptualizing the crime drop as a homogeneous process may provide too simple an account of different patterns of change across both sex and age.

Table 7.5. Comparison of relative contributions of age, prevalence and frequency to overall convicted offending rates for men and women 1989-2000, 2000-2007, 2007-2011.

Period	Effect	Men	Women
One (1989-2000)	Age (α)	-13.26	-10.36
	Prevalence (β)	-17.66	-1.11
	Frequency (γ)	-0.63	-1.60
	Total	*-31.55*	*-13.07*
Two (2000-2007)	Age (α)	-2.24	-2.61
	Prevalence (β)	+9.07	+20.41
	Frequency (γ)	-2.34	-0.90
	Total	*+4.49*	*+16.90*
Three (2007-2011)	Age (α)	-0.92	-0.96
	Prevalence (β)	-10.27	-18.83
	Frequency (γ)	-0.25	+1.63
	Total	*-11.44*	*-18.16*
Total (1989-2011)	Age (α)	-13.92	-11.32
	Prevalence (β)	-20.52	-1.50
	Frequency (γ)	-4.06	-1.52
	Total	*-38.50*	*-14.33*

Source: Conviction data from SOI, population data from National Records of Scotland (2014). Figures to 2dp. Percentages are calculated using unadjusted 1989 rate of convicted offending for men and women respectively.

7.5 Discussion

The findings of this chapter have extended those presented in Chapter Six by assessing the relative importance of change in prevalence to overall rates of convicted offending compared to the impact of changing age structure and frequency of convicted offending. For both men and women change in age structure led to lower conviction rates for both sexes between 1989 and 2011, and particularly through the 1990s. For young men, the 1990s was also a period of declining prevalence. From 2000-2007, when the prevalence of convicted offending increased for men and women in their mid-twenties to early forties, change in both age structure and the frequency of convicted offending served to mediate these increases

on overall convictions rates. In contrast to the crime drop through the 1990s, between 2007 and 2011 both men and women show declines in standardized convictions rates primarily due to declining prevalence of convictions, with only small contributions from changes in age structure. These results have a number of implications for our understanding of change across the different dimensions of criminal careers, and for the study of the impact of demographic change on crime rates.

First, the results of this chapter are in agreement with the finding of Chapter Six that increases in the prevalence of conviction between 2000 and 2007 are best explained by a process of net-widening. The results presented in this chapter have show that increases in prevalence are accompanied by aggregate declines in frequency between 2000 and 2007. As discussed in Chapter Three, this is what would be expected by an influx of people with low numbers of convictions. This dovetails with the findings of Chapter Six that increases in prevalence during this period are best explained by a period effect, and hence system, effect. That these effects are experienced by women to a greater magnitude than men also fits with Estrada et al.'s (2015) suggestion that women are likely to be disproportionately affected by net-widening. This is a theme that is discussed in greater detail in Chapter Ten, drawing on results from Chapters Eight and Nine.

Second, the observation of contrasting trends between prevalence and frequency is an illustration of the value of Blumstein et al.'s (1986:1-2) suggestion that change in aggregate crime rates can be manifest differently across different parameters of criminal careers. This reiterates that aggregate statistics can mislead (Berg et al. 2016), and that to fully understand the crime drop criminologists should not limit themselves to the analysis of aggregate data. As a result, when these concepts are used to describe the 'anatomy' of aggregate change in convictions, Gottfredson and Hirschi's (1987) contention that the distinction between prevalence and frequency is not important is misleading. In this context, analysing changes as broken down into components of prevalence and frequency can provide insight into the development of the 'crime drop' which would not be possible focusing on aggregate conviction rates.

This analysis has also presented three methodological advances over the existing uses of standardization and decomposition analysis to examine the impact of demographic change on crime rates. In examining the impacts of prevalence and frequency as distinct, the analysis presented here provides an advance on previous decomposition analyses of the contributions of population change to the crime drop, such as that of Levitt (1999). Calculating standardized rates using methods using three factors allowed this analysis to separate out the effects of prevalence and frequency. The differing trends displayed by prevalence and frequency in this analysis would have been conflated in a two-factor standardization. Whilst the capacity to include these three factors is dependent upon suitable data being available, these results suggest that future standardization and decomposition analysis using convictions data should consider these factors as distinct if possible. If this is not possible, results should be understood as primarily representing prevalence.

In addition to the benefits of conducting standardization and decomposition with three factors, this analysis has demonstrated the value of calculating multiple standardization and decomposition analyses across different time periods, informed by a descriptive understanding of trends in the data. Comparing results of different periods with those for 1989 to 2011 as a whole, this analysis has shown that the effect of age-structure, prevalence and frequency is very unevenly distributed across across time. However, the different trends across periods seen in the standardization and decomposition here are obscured when only examining the start and the end of SOI. Future decomposition analysis of the impact of age-structure on crime rates should be informed by preliminary inspection of the data to identify potential turning points or non-linear trends which must be accounted for during analysis.

Similarly, presenting the contributions of different ages to the standardization and decomposition analysis illustrated that change across these three factors was unevenly distributed over age, with young people showing different trends to those from their mid-twenties to early forties. These differences are obscured by aggregate analysis, and again future standardization and decomposition analysis would benefit from investigating the different contributions of different ages to overall trends to identify where in the age-spectrum change has occurred.

7.6 Conclusion

This chapter aimed to answer the research question 'What are the contributions of prevalence, frequency and age-structure to falling conviction rates?' The results show that between 1989 and 2011 the prevalence of convictions was the most important factor influencing conviction rates for men, whilst age structure was the most important influence on convictions rates for women. However, the different periods identified in Chapter Six (1989 to 2000, 2000 to 2007 and 2007 to 2011) show very different relationships between prevalence, frequency and age structure. Changes in age-structure in the population led to falling convictions rates for men and women through the 1990s. This combined with falling prevalence of conviction for men during this period, but not for women. In contrast, in the early to mid-2000s prevalence increased for both men and women, but the effects of increasing prevalence were tempered by age-structure serving to reduce convictions during this period. The final period of crime drop from 2007-2011 is almost exclusively due to falls in prevalence, with little impact of age-structure, and unlike between 1989 and 2000 this is seen for both men and women. Frequency had only a marginal effect on conviction rates in any period.

Original contribution

This analysis presents two methodological contributions to the literature examining the relationship between age-structure and crime rates. By using three-factor standardization and decomposition and by analysing trends using comparison years informed by descriptive statistics, this analysis presents a number of advances over work that uses two-factor decomposition. The contrasting trends for prevalence and frequency show that inferences made when examining a combined measure of arrest rate, as in Levitt (1999), cannot be inferred as representing consistent trends for both prevalence and frequency. Moreover, comparing trends between periods shows that the relative impact of these factors can change substantially over time. Sensitivity analysis of this kind is encouraged in future applications of standardization and decomposition analysis to compare temporal change in crime rates and age structure to illuminate potential bias resulting from the time points selected.

Substantively, the finding of differential effects of age-structure, prevalence and

frequency for men and women of different ages suggests that the results of the previous analysis of change in prevalence and frequency over the course of the crime drop in the 1990s (Berg et al. 2016) may not be generalizable beyond the narrow range of men aged 17-18 covered in Berg et al.'s (2016) study. These discrepancies across age, sex and period emphasise the value of using the breadth of data afforded by using an administrative dataset to complement analysis using self-report studies with a more limited demographic scope.

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The analysis presented in this chapter has focused on the aggregate level. Whilst informative of overall patterns of change, this cannot examine potential change within the population of those who offend. For example, aggregate change in prevalence may also represent change in the mix of high and low-frequency offenders within the population of those who offend (Farrell et al. 2015). This raises the possibility that aggregate change may be due to change in the mix of sub-populations within the population of those who offend and in particular the mix of high-rate and low-rate offenders. As the measures used to this point have considered prevalence and frequency only relating to offences committed within the same calendar year such change may not be captured by aggregate measures of frequency, and are likely to be influenced by the high volume of people with single convictions in SOI. To investigate potential change across different groups of convicted offenders, the next chapter of the thesis examines change in the membership of different convictions groups based on the variety and frequency of convicted offending over a longer time period.

Chapter Eight: A crime drop for whom? polarisation and the crime drop

8.1 Introduction

This chapter aims to examine change in the membership of sub-groups within the population of those convicted in Scotland from 1989 to 2011 in order to answer the research question 'Has the distribution of convictions become more polarised over the crime drop in Scotland?' To answer this question first requires the classification of people into different convictions groups via latent class analysis (Section 8.2). Analysing polarisation involves describing trends in class membership over time and the contribution of these classes to the overall volume of convictions. This can show whether the high-rate offending classes identified comprise an increasing proportion of people convicted and of total convictions. In doing so this analysis extends the results presented in Chapters Six and Seven from the aggregate level in order to assess whether falls in the number of convicted offenders are seen for all groups of offender. Results of this analysis are presented in Section 8.3 and show that for young men and women a low-rate conviction class identified by Latent Class Analysis comprises an increasing proportion of the convicted population. However for men and women over the age of 26 the proportion people classified into this low-rate convictions class falls. This suggests that the extent of 'polarisation' over the course of the crime drop varies substantially for different age groups.

This chapter also aims to link analysis of polarisation to understandings of the overall crime drop. The classification provided by LCA can also be used to assess whether falls across crimes of dishonesty – seen as being particularly important to overall declines in convictions in Chapter Six – are general, or whether they are specific to a particular group of people. This helps to link analysis of polarisation with the research objective of understanding the mechanisms leading to falling conviction rates. Section 8.4 presents these results, which show that the proportion of convictions for dishonesty remains largely consistent across convictions classes, despite sizeable declines in the membership of the Dishonesty class identified by the LCA. This implies a general effect of falling crimes of dishonesty affecting all classes identified by the model. Analysing these trends by age shows divergent patterns for

young men and young women assigned to the Dishonesty class which suggest that there may be gender differences as to what the classes identified by LCA represent.

8.2 Identifying a LCA solution

This section presents the preferred latent class solution used to explore changes in polarisation over the course of the crime drop. This section begins by briefly reviewing descriptive statistics of the data used to construct the LCA, followed by presenting the statistical fit criteria for different latent class solutions. The substantive meaning of classes produced by different solutions are then discussed. These three steps give an indication of how the different LCA solutions are dividing up the SOI data, and based on these criteria a three-class LCA solution is preferred. The details of this solution are then presented.

Descriptive statistics

Figure 8.1 shows the number of people convicted in different five-year age bands between 1989-1993 and 2007-2011. The red line represents the number of men convicted and the blue line the number of women. Numbers of people convicted are indexed in order to compare trends across different age bands. These figures are naturally very similar to annual change in the prevalence of conviction as discussed at length in Chapter Six, with falling numbers of young people, and especially young men, convicted. In contrast, there are increases in the numbers of those convicted over the age of 36.

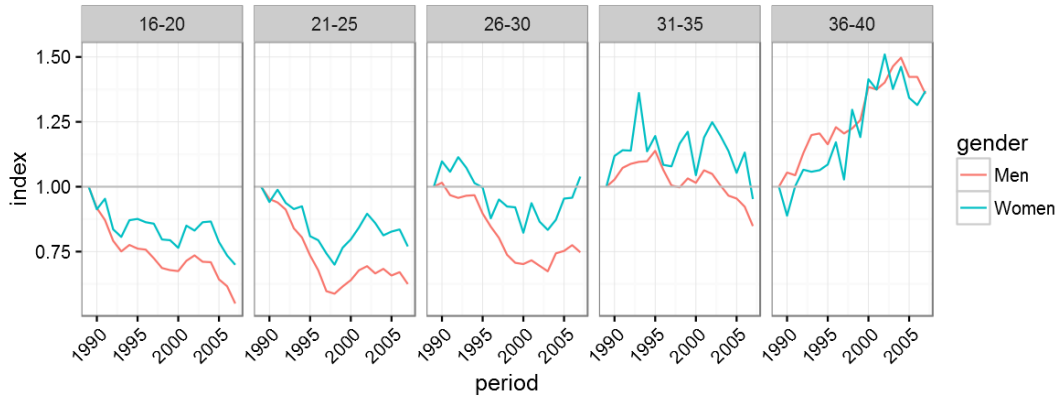

Figure 8.1 Numbers of people convicted in five-year age-bands, 1989-1993 to 2007-2011

The falling number of people convicted shown in Figure 8.1 suggests the value of describing proportional change in the membership of different classes to hold these declining base-rates constant. This allows the analysis to focus on the mixture of classes within the population as a whole in each five-year period. It also points to the value of considering change in polarisation for different age groups, as focusing on overall trends in polarisation may be skewed by the shift in the demographic mix of the convicted population over time.

Crime means

Figure 8.2 shows the mean number of convictions per person convicted of all crime types, as well as the figures for individual crime types. This figure shows that the average number of convictions has shown very little decline for men (from 2.45 for the period 1989-1993[125] to 2.25 for 2007-2011). For women the mean number of convicted offences actually increased between 1989 and 2011, from roughly 1.8 to 1.9. When analysed by type of crime, there has been a steady decline in the average number of convictions for crimes of dishonesty for both men and women. The mean number of convictions for dishonesty falls from close to one conviction per person convicted for both men and women in 1989 to just over to 0.5 convictions for men and 0.6 for women. Other crime types show much less change. Violence shows the largest rise, increasing from a mean of close to 0.45 for men in 1989-1994 to 0.6 in 2007-2011. For women the increase is even larger, from 0.3 in 1989-1994 to 0.6 in 2007-2011. The contrast in the steady total average number of convictions[126] and the declining rate of convictions for dishonesty suggest that the mix of convictions for which men and women were convicted was greater in 2007-2011 compared to 1989-1993. The results of the latent class analysis, then, will partition this decline across different classes.

125 This is labelled as 1989 in Figure 8.1. This convention is adopted throughout this chapter, so that when x-axes refer to year this is always the beginning of the five-year window.

126 These results also emphasise the importance of prevalence in reducing overall convicted offending rates as shown in Chapter Seven, as there is little change in the frequency of convicted offending over time.

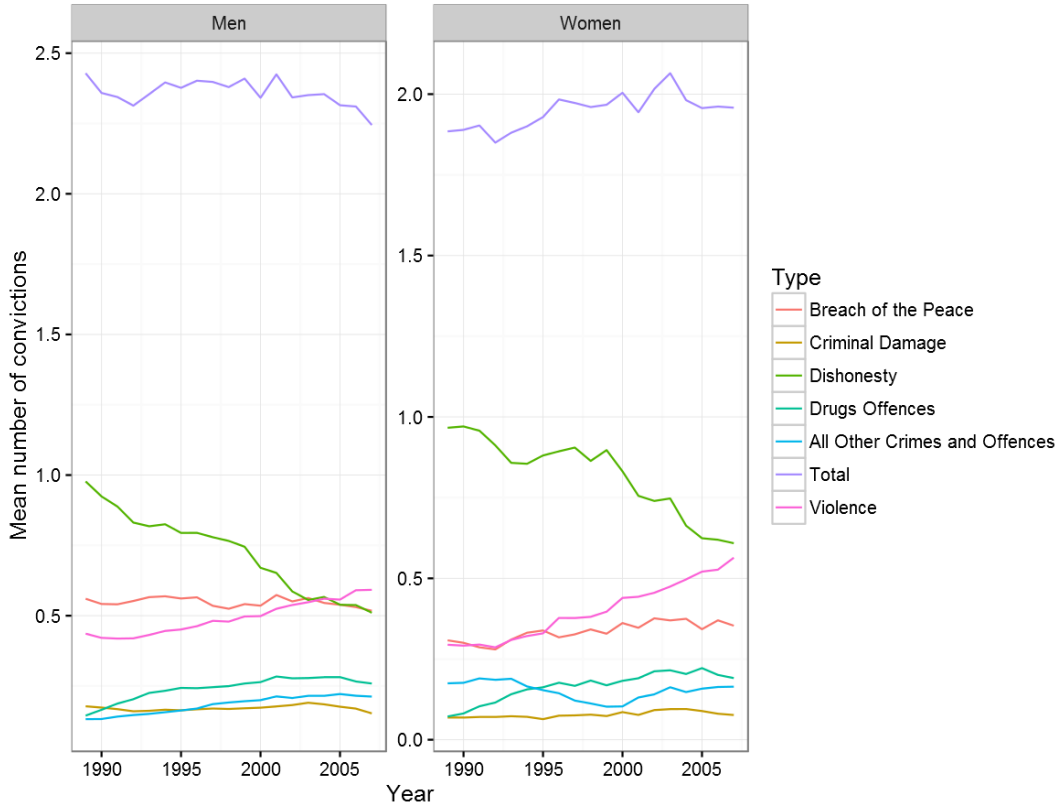

Figure 8.2 Mean number of convictions in five year periods, 1989-2011.

Identifying the preferred LCA suitable solution: Model fit statistics

Having examined descriptive statistics for the variables used in this chapter, focus now moves to the Latent Class Analysis itself. LCA was conducted by running a number of models with an increasing number of classes, with the fit of different class solutions analysed by AIC, BIC and ABIC. Figure 8.3 shows the AIC, BIC and ABIC results for solutions for up to five classes[127]. Results are presented for models run on each age band separately and then for all age-bands together. This approach helps to identify whether LCA solutions fit different ages equally well, following the procedure suggested by Nylund (2007).

Overall, AIC, BIC and ABIC provide a mixed picture of the best-fitting number of classes for different ages. For each age band, ICs declined with an increasing number of classes. However, the improvement in model fit with each subsequent class after the *k*=2 solution is small, consistently less than 0.5% of the IC value for the *k*=1

127 LCA models for higher number of classes failed to identify global maxima, and so results were not considered reliable.

class. Further complicating the picture, Figure 8.3 shows differences across age in the relative fit of solutions with increasing *k* classes. The improvement in fit is greater moving from two to three classes for those age 26-30 and 31-35 than for age 16-20. The analysis for the whole dataset is closer to that for those aged 16-20 only, showing a sharp improvement from one to two classes and a much more gradual improvement after this point. This difference over age in the performance of fit statistics suggests that the solution adopted will necessarily be a compromise between fit to the data at different ages and summarizing the pattern of convictions in the SOI as a whole.

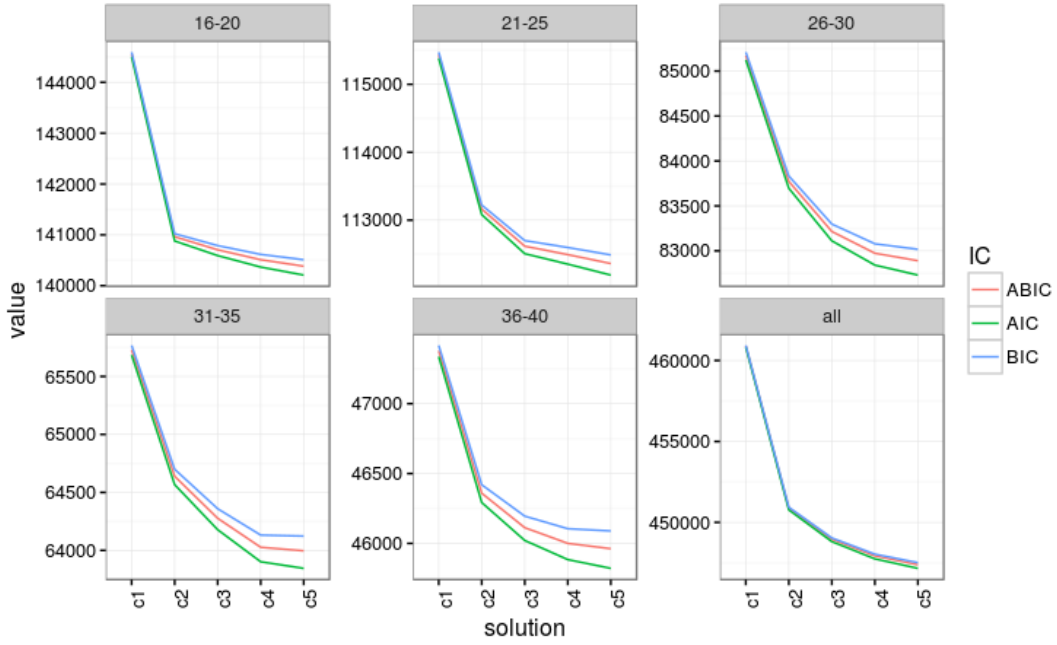

Figure 8.3 IC results for LCA solutions for different *k* classes

To provide further information about the LCA model fit, the VLMR test (see Chapter Five) was used to investigate the preferred number of latent classes to describe the variation in the SOI data. VLMR showed a significant improvement in fit to the data comparing 5 to 4, 4 to 3 and 3 to 2 class solutions[128]. This result is in accordance with the decline in ICs with an increasing *k* classes. Based purely on fit statistics then, LCA favours a five-class model. However, this preference for a larger number of classes may simply reflect skew in the underlying distribution of SOI data (Muthén

128 Mplus produced p-values of 0.0000 for when comparing the fit of *k*=5 to *k*=4 and *k*=4 to *k*=3 classes. By this measure the five-class solution fits the data better than the four class solution, and the four class solution fits the data better than the three-class solution.

2013) rather than the presence of substantively interpretable groups.

To assess the substantive nature of the different classes produced, change in class proportions and class membership across latent class solutions were analysed. This analysis is presented in full in Appendix 13. Examining the substantive make-up of the different *k* solutions suggested that either the *k*=3 or *k*=4 solutions are to be preferred for this analysis. The additional class created between *k*=4 and *k*=5 solutions was substantively very similar to classes already included in the *k*=4 solution and so was not considered to justify the additional class. Similarly, the additional class created by the *k*=4 solution – a class marked by low rates of crimes of dishonesty – was substantively similar to the dishonesty class identified in the *k*=3 solution.

As a result, balancing statistical and substantive criteria, the k=3 solution is considered the most suitable for the following analysis. Whilst purely statistical measures of ICs and VLMR all favoured the *k*=4 solution, there is questionable substantive significance of adding an extra dishonesty class to the model, particularly given the deterioration in classification quality between *k*=3 and *k*=4 models which is attributable to the inclusion of the low-rate dishonesty class[129]. The reductions in AIC, BIC and ABIC from the *k*=2 to *k*=3 model indicated that the *k*=2 model provided an insufficient account of the variation in the SOI data. Furthermore, given the importance of crimes of dishonesty to both theories of the crime drop as discussed in Chapter Three, the Dishonesty class identified by the *k*=3 solution has important substantive value when investigating changing convictions patterns over the course of the crime drop.

Profiles of classes produced by *k*=3 solution

Figure 8.4 shows the mean number of convictions[130] for different crime types for the *k*=3 solutions estimated on data split by different age bands and also on data for all ages. These results show that the model results are similar across age, producing one class with a low rate of convictions, one with a high rate of convictions for all crime types, and one with a high rate of convictions for dishonesty and drugs offences, but low rates of convictions for other crime types. These classes are referred to as Low,

129 See Appendix 13.
130 Figures are the exponents of the intercepts produced by the LCA.

High and Dishonesty respectively.

Table 8.1 shows the proportion of people divided into these different classes for the k=3 solution as well as the entropy value for this solution. The distribution of conviction classes is very uneven in this classification, with the low-rate class making up over 82% of all age-bands convicted. The Dishonesty class comprises just less than 12% of the age-bands analysed, and the High class just less than 6%. This small proportion of the High rate class is typical of previous analyses of 'chronic' offenders and offending trajectories (see Chapter Two). The entropy score of 0.721 suggests a reasonable classification quality, but not one sufficient to use most-likely class as an indicator of class membership (Clarke and Muthén 2009). This is accounted for by weighting class membership by the probability of each age-band belonging to a different latent class.

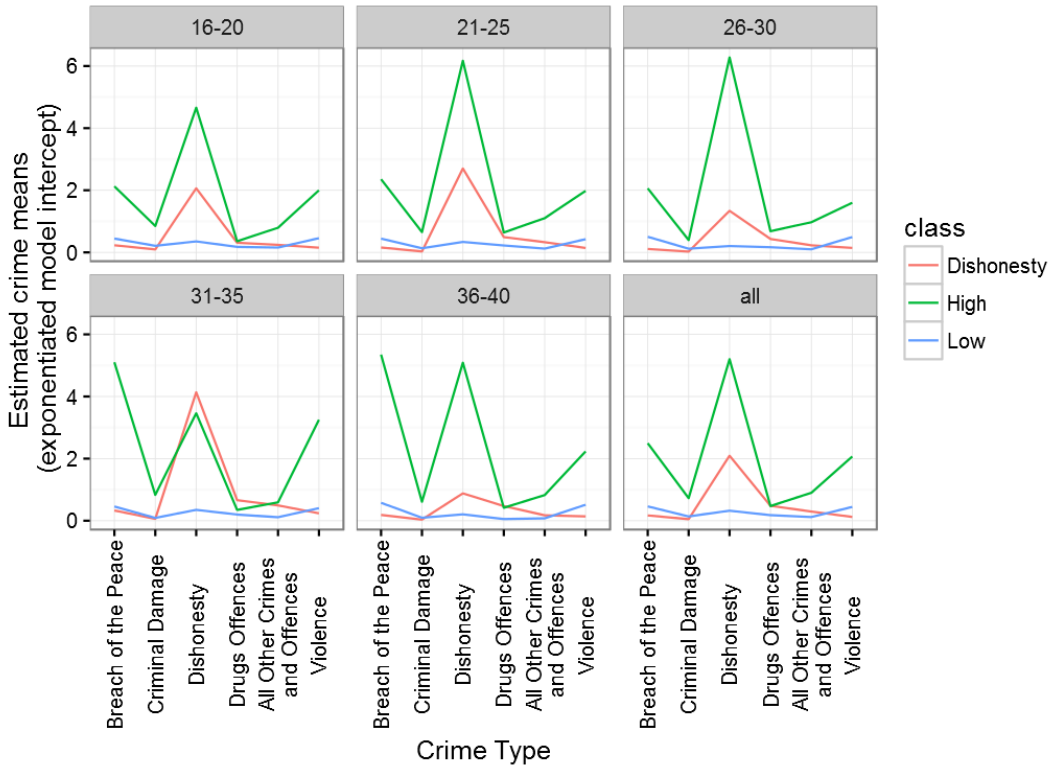

Figure 8.4 Profile of different *k* classes for LCA solutions estimated for different age bands and SOI as a whole

Table 8.1 Class proportions for LCA estimated on all age bands (posterior probabilities)	
	k
Class Description	3
Low	0.823
High	0.059
Dishonesty	0.119
Entropy	*0.721*
Source: SOI	

8.3 Change in polarisation over time

Having identified a preferred latent class solution, this taxonomy can now be used to examine whether convictions have become more 'polarised' over the course of the crime drop in Scotland. This is achieved in two ways. First, examining the proportions of people classified into the different LCA groups over time can assess whether an increasing proportion of age-bands are classified into the Low rate conviction class. If there is an increase in the proportion of people grouped into these classes over time, the population can be considered less polarised. Second, the same process is conducted focusing the concentration of *convictions*, rather than people attributable to the Low rate class. This examines another aspect of the potential 'polarisation' of offending; whether high-rate offenders contribute an increased share of overall convictions. This analysis first presents results for all men and women, and then for men and women of different ages. It should be noted at this point that the use of five-year age-bands means that the focus of this chapter is predominately on the periods of declining convictions through the 1990s and the increases in convictions from 2000 to 2007. This is because only the last period analysed (2007-2011) refers to the second period of crime drop after 2007. Consequently, this analysis cannot illuminate changes in patterns of convictions over this more recent period of crime drop.

Change in class membership over time

Figure 8.5 shows trends in the proportion of class membership of the three latent classes described above. The proportion of men grouped into each class is represented by the red line and the proportion of women by the blue line. Years listed on the *x* axis mark the start of the five-year window. This convention is adopted throughout the chapter.

Figure 8.5 shows that there has been substantial change in the membership of these different latent classes over time, particularly shown by a fall in the membership of the Dishonesty class (a fall of around 4 percentage points for women and 2.5 percentage points for men) and an increase in the membership of the Low class (up by around 3 percentage points for women and 2 percentage points for men). Membership of the High class increases for both men and women by around one percentage point, a lower rate of change than for Low and Dishonesty classes. This figure also illustrates that membership of the Dishonesty and High rate classes are quite different between men and women, with women comprising around 3.5 percentage points more of the Dishonesty class and 3.5 percentage points less of the High rate class than men. The lower proportion of women classified into the High rate class is in line with expectations of previous analyses where latent convictions trajectories have been estimated on mixed-sex samples (see Chapter Two).

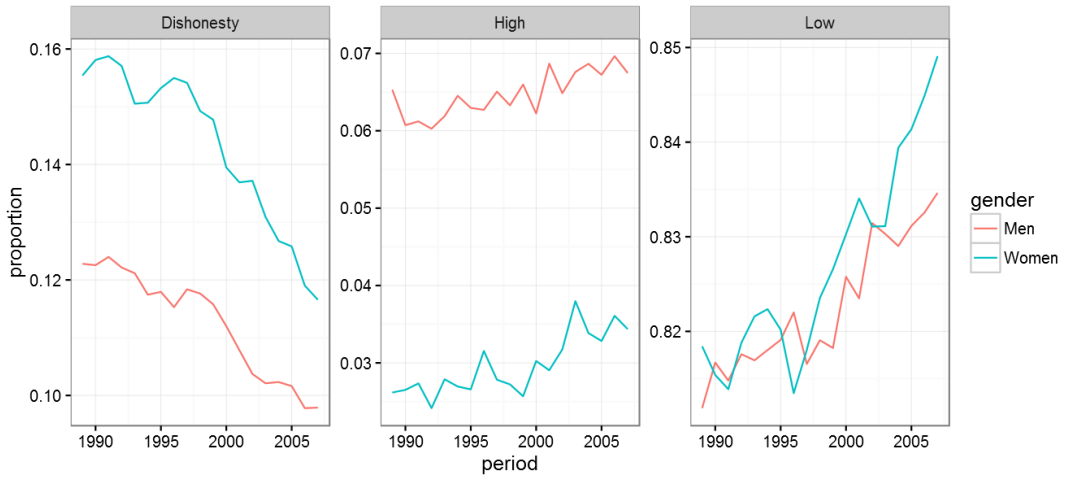

Figure 8.5 Change in the proportion of people assigned to different latent classes

These results may initially seem somewhat counter-intuitive. Membership of the Low class increases, suggesting less polarisation, but at the same time membership of the High class also increases, suggesting more polarisation. These contradictory findings are explained by both High and Low classes expanding as a result of lower membership of the Dishonesty class. It should also be noted that because this focus is on the *proportion* of people classified as High rate offenders, this increasing proportion of men and women classified into the High rate class reflects a falling

absolute number of people included in this class[131] because of the fall in the numbers of men and women convicted overall (see Chapter Six).

Change across age

To examine how these trends in the proportions of class membership change with age, Figure 8.6 shows the proportions of men and women of different ages assigned to the three latent classes. Proportions are calculated based on the number of people of each sex in each age-band, and so sum to one in columns. This figure is presented with age running in panels from right-to-left, and by class running in the panels from top-to-bottom in the order Dishonesty, High and Low. Importantly, Figure 8.6 shows that there is no uniform answer to whether the population of people conviction has become more polarised, with substantial variation across age for men and women in the changing proportions of people grouped into different latent classes.

Starting with the youngest age bands, the Low offending class comprises an increasing proportion of those aged 16-20, and the same is true for men and women aged 21-25, although this increase in relative size of the Low class comes only after 1998. For these age groups then, the trend is of a decline in polarisation, with the Low class comprising an increasing proportion of those convicted. Figure 8.4 also shows that this increase in the proportion of men and women aged 16-20 classified into the low class is entirely due to declines in membership of the Dishonesty class. Membership of the High class remains stable for men and increases by 1.5 percentage points for women. That the sharp falls in membership of the Dishonesty class occur around 1993 for the 16-20 age group and in 1999 for the 21-25 age group suggest a potential cohort effect driving these trends.

These trends are very different to those seen for older age-bands. The three oldest age-bands show little change in the size of the Low class for women, with the exception of a fall of two percentage points for the 31-35 age groups, but the Low class comprises a shrinking proportion of total men convicted of these ages.

131 Trends in the numbers of people classified into the three latent classes are presented in Appendix 14.

Figure 8.6 proportion of men and women of different ages assigned to latent classes

Similarly, for the three age bands representing people over the age of 26 there are increases in the proportion of men classified into the Dishonesty class of between one and two percentage points, whilst the proportion of women grouped into this class shows little aggregate change. For young people the population of those convicted has become less polarised, but for men over the age of 26 these results show increasing polarisation.

Not only has the rate of conviction increased for men over 30 between 1989 and 2011 (Chapter Six), but the proportion of this age group who are classified into the High and Dishonesty class has also increased. One potential explanation for this finding of an increasing membership of the Dishonesty class for older men and women could be the presence of particular cohort(s) with high rates of drugs offences and crimes of dishonesty. Morgan (2014) suggests that the ageing of a cohort of people particularly affected by the heroin and crack cocaine epidemics of the late 1980s may constitute such a cohort. Whilst SOI does not contain sufficient data to assess whether there is a relationship between drug use (as opposed to convictions for drugs offences) and these cohorts, such an explanation would be consistent with the increase in membership of the Dishonesty class identified here[132]. This emphasises again the importance of examining differences across age to understanding the crime drop.

Comparison with previous analyses of polarisation

These results have two main implications for the current literature examining the polarisation of offending. First, these findings are in agreement with Bäckman et al. (2014) and von Hofer (2014) who saw the frequency of high-rate youth offenders in Sweden fall between 1973 and 2008. These results also suggest a falling proportion of high-frequency offenders, as measured by combined membership of the High and Dishonesty groups, amongst young people who were convicted throughout the crime drop of the 1990s.

In contrast to these falls in polarisation for young men and women, the proportion of those over the age of 25 classified as high-rate offenders, both in membership of

132 Such an explanation would be in line with the identification of the class dominated by convictions for drugs offences in the k=5 solutions for the 31-35 and 36-40 age-bands (see Appendix 13).

High and Dishonesty classes, has increased. This coincides with increases in the prevalence of convictions for these ages (see Chapter Six). Due to the difference in base-rates, falls in convictions for young people once again outweigh increases in convictions for older people. These findings also suggest an important caveat to previous examinations of polarisation; that changes in the mix of young offenders may not be representative of older people. Making inferences about change in the distribution of offending (or conviction) based only on patterns of offending (or conviction) among young people is likely to provide a misleading account of change in conviction over the course of the crime drop. Similarly, focusing only on aggregate change (i.e. examining all age groups together) as in Figure 8.3 will not provide an accurate picture of change amongst older people. Trends for all age groups predominately reflect patterns of change for young people and so obscure trends for older people.

Change in the contribution of latent classes to the total volume of convictions

The second way to assess polarisation over the course of the crime drop is to examine the proportion of convictions attributable to the members of different latent convictions groups, rather than the proportions of people classified into different groups. The link between these two measures is the average number of convictions per person convicted for each group. Consequently, this section first analyses the average number of convictions for members of different latent classes, before examining the contributions of these different classes to the overall volume of convictions in each five-year period.

Change in the frequency of convictions for different latent classes

Figure 8.7 shows trends in the frequency of convictions for members of different latent classes over time. A *loess* curve has been fitted to these figures to clarify the trends in the data. The most obvious feature of these results is that the three classes show different levels of overall convictions. Unsurprisingly, the High class has a higher average number of convictions than the Dishonesty class, which in turn has a higher frequency of conviction than the Low class. This difference between groups is consistent over time, with little change observed in the frequency of convictions. The largest change observed is that the mean number of convictions for men in the High

rate group falls from 9.5 in 1989-1993 to 8.5 by 2007-2011, and for women in this group the mean falls from 10.5 to 9.5 over the same period. It should be noted though that these groups also have the greatest variation in estimates of frequency from year to year, shown by the wider confidence intervals around the *loess* curve. There is little substantive change for men and women classified into the Low class, at around 1.8 and 1.5 convictions respectively. Similarly there is little change in the average number of convictions for men or women in the Dishonesty class, with the average frequency for men falling from 3.5 to 3 convictions and for women increasing from 3 to 3.3 convictions per person.

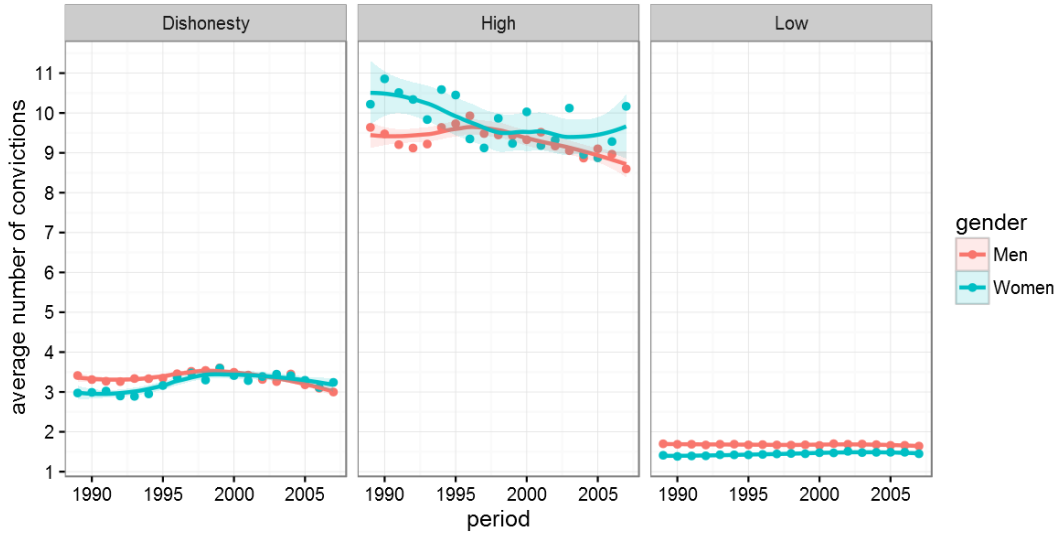

Figure 8.7 Trends in the frequency of conviction for different latent classes

This consistency derives from the way the LCA was constructed; the model grouped together people with similar convictions patters based on their frequency of conviction for different crime types, and so it is little surprise that the profile of the classes remained mostly consistent over time. Whilst Figure 8.7 does suggest that changes in the frequency of convictions for the High rate class may decrease the share of overall convictions served to this group to some degree, the consistency in the average number of convictions to members of different groups implies that the change in proportion of overall convictions is likely to be similar to the change in the proportion of people assigned to different classes.

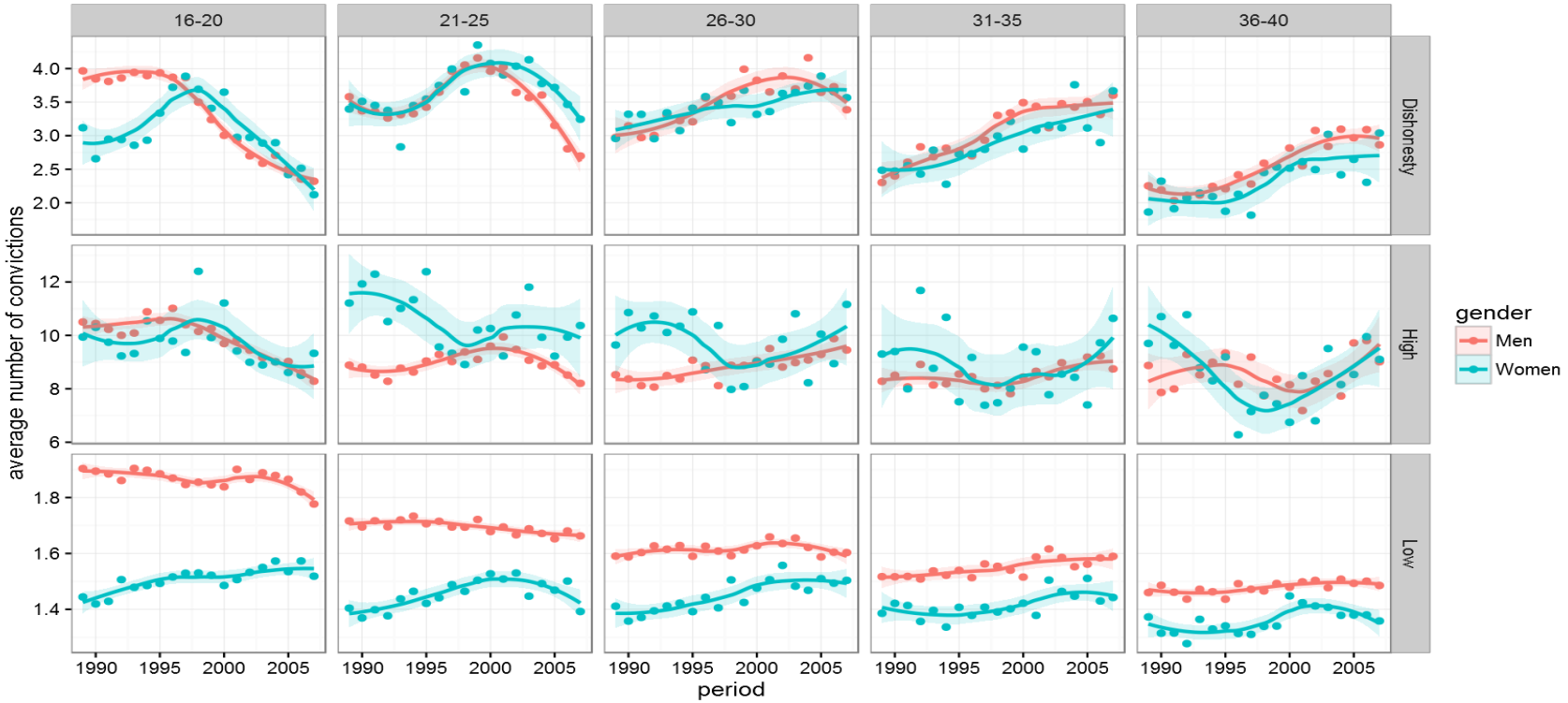

Figure 8.8 Trends in the frequency of conviction for different latent classes split by ageband

Figure 8.8 shows these trends in the average number of convictions for different age groups. On the whole, Figure 8.6 shows a small magnitude of change in the frequency of convictions across different age bands. The primary exceptions to this are the falls in the frequency of conviction for men and women aged 16-20 classified into the Dishonesty class after 1995, and the similar decline for those aged 21-25 after 2000, and the increases of around one conviction per person convicted for men and women aged 26 and over. For the High class there is a sufficient amount of variation in the average number convictions for women that it is not possible to identify a solid trend over time, whilst for men there is a small fall in frequency (two convictions per person convicted) for the youngest age band, but little change for older ages. The magnitude of change in the frequency of convictions for the Low class is very small. For the youngest age-band in the Low class men show a slight fall in frequency of around 0.1 conviction, whilst for women in the first and third age-bands the frequency of the Low class increases from 1.4 to 1.5 convictions. Men aged 21-25 also show slight falls in frequency, whilst men of older ages show little change. There is also little change in frequency for women in the second, fourth and fifth age-bands.

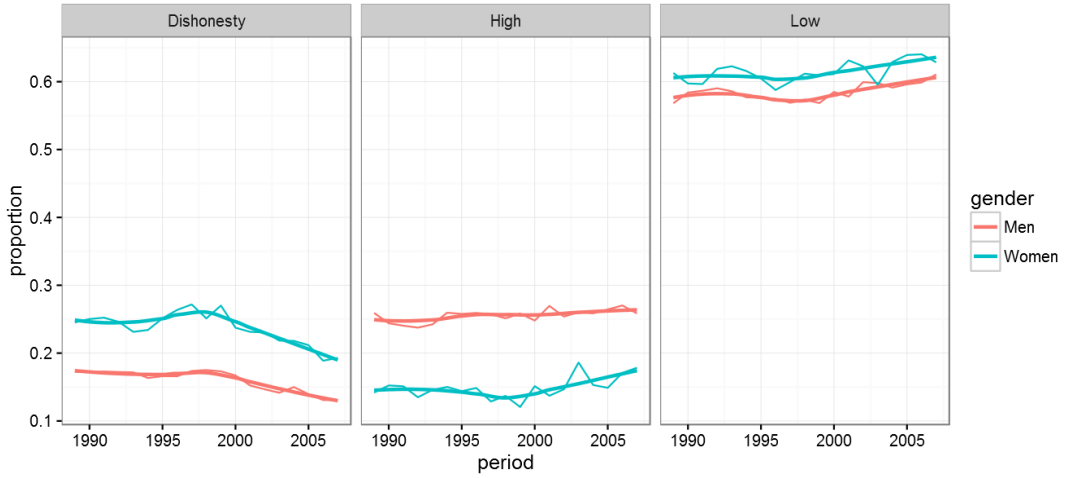

Figure 8.9 Trends in the proportion of total convictions attributable to latent classes

Figure 8.9 shows the contribution of different latent classes to the total number of convictions for men and women in a given five-year period. This presents the combined effects of prevalence and frequency. The left-hand panel shows the proportion of convictions served to men and women in the Dishonesty class, the middle panel shows the proportions grouped into the High rate class, and the right-hand panel shows the proportion of convictions served to the Low class. For men,

the High rate class consistently receives around one quarter of all convictions (note, from Figure 8.3, this class comprises between 6% and 7% of men convicted). Members of the Dishonesty class have a lower proportion of all convictions served to men, receiving around 17% of convictions served to men from 1989-1999, before falling steadily to 13% by 2007. The result is one of divergence in the proportion of total convictions served to men in the High and Dishonesty classes and an increase in the proportion of convictions served to the Low offender class, with the Low group receiving 57% of the total convictions served to men in 1989-1993 and 62% in 2007-2011.

Whilst for men the share of total convictions given to High and Dishonesty class diverges, for women the proportions of convictions served to these classes converge. This is because, unlike men, at the start of the period covered by SOI the Dishonesty class for women contributed a larger proportion of the total volume of convictions served to women (25%) than the contribution of the High rate class to total convictions for women (around 15%). By 2007 the Dishonesty class contributes just less than 20% of the convictions for women, with the High rate class receiving close to 17%. The proportion of convictions served to women in the Low class increases slightly from just over 60% in 1994 to 63% in 2007. These trends in the proportion of total convictions echo those observed for the numbers of people assigned to different classes (Figure 8.3), with greater falls for total convictions served to the Dishonesty class relative to the other two classes. This is because, other than a fall in the frequency of conviction for young men and women assigned to the Dishonesty group, there has been little substantive change in the frequency of conviction for members of different latent classes over time, as shown in Figure 8.6. Whilst there are differences in degree between groups and between men and women, this fall in the proportion of convictions served to the Dishonesty class is offset by increases in the proportion of convictions served to both Low and High classes. Once again, the end result is that both men and women show lower levels of polarisation as measured by an increasing proportion of convictions attributable to the Low rate class, but also an increasing proportion of convictions attributable to the High class.

Set against a backdrop of falling convictions overall, this consistency in the proportion of convictions served to different latent classes suggests that the crime

drop has affected the High class in a similar fashion to the Low class. It is the Dishonesty class which has been the main driver of the fall in convictions. Consequently, Figure 8.9 supports the inference made from Figure 8.5 that the crime drop is not due to a fall in the frequency of conviction served to high-rate offenders.

The combined effect of the contrasting trends in polarisation between the younger and older age bands analysed is that the overall volume of convictions is more evenly distributed over age and latent classes. Figure 8.10 displays the proportion of total convictions for men and women in each year attributable to each latent class and age band. The proportions of convictions served to ages 26 and above increases for all latent classes. In contrast, the proportion of total convictions attributable to the Dishonesty and High classes fall for the youngest age band. Linking these results back to those presented in Figure 8.9 shows that the consistent proportion convictions served to men attributable to the High class represents the combination of divergent trends for different age groups. Whilst the High rate group as a whole provide a consistent proportion of convictions for men, contributions to total convictions made by young men assigned to the High rate class fall. The decline in convictions served to young men in the High class is counterbalanced by increases in convictions served to older men assigned to the High rate group. Similarly, for both men and women the fall in convictions assigned to the Dishonesty class is driven by the age bands 16-20 and 21-25; the proportion of total convictions served to older men and women assigned to the Dishonesty class increases.

Figures 8.9 and 8.10 helps to compare the analysis of polarisation presented here with the findings of falling prevalence of convictions for young people but increasing prevalence of convictions for older adults presented in Chapter Six. The crime drop has seen convictions become less concentrated towards young people, as shown by the change in the age-crime curve seen in Chapter six, and particularly amongst the young men grouped into the High and Dishonesty classes. In contrast, for ages 26 and above, membership of the Dishonesty and High rate classes has increased alongside a higher prevalence (Chapter Six) and frequency (Chapter Seven) of conviction. The combined effect of these changes is to produce a more even distribution of convictions across age groups – as shown in the changing age-crime

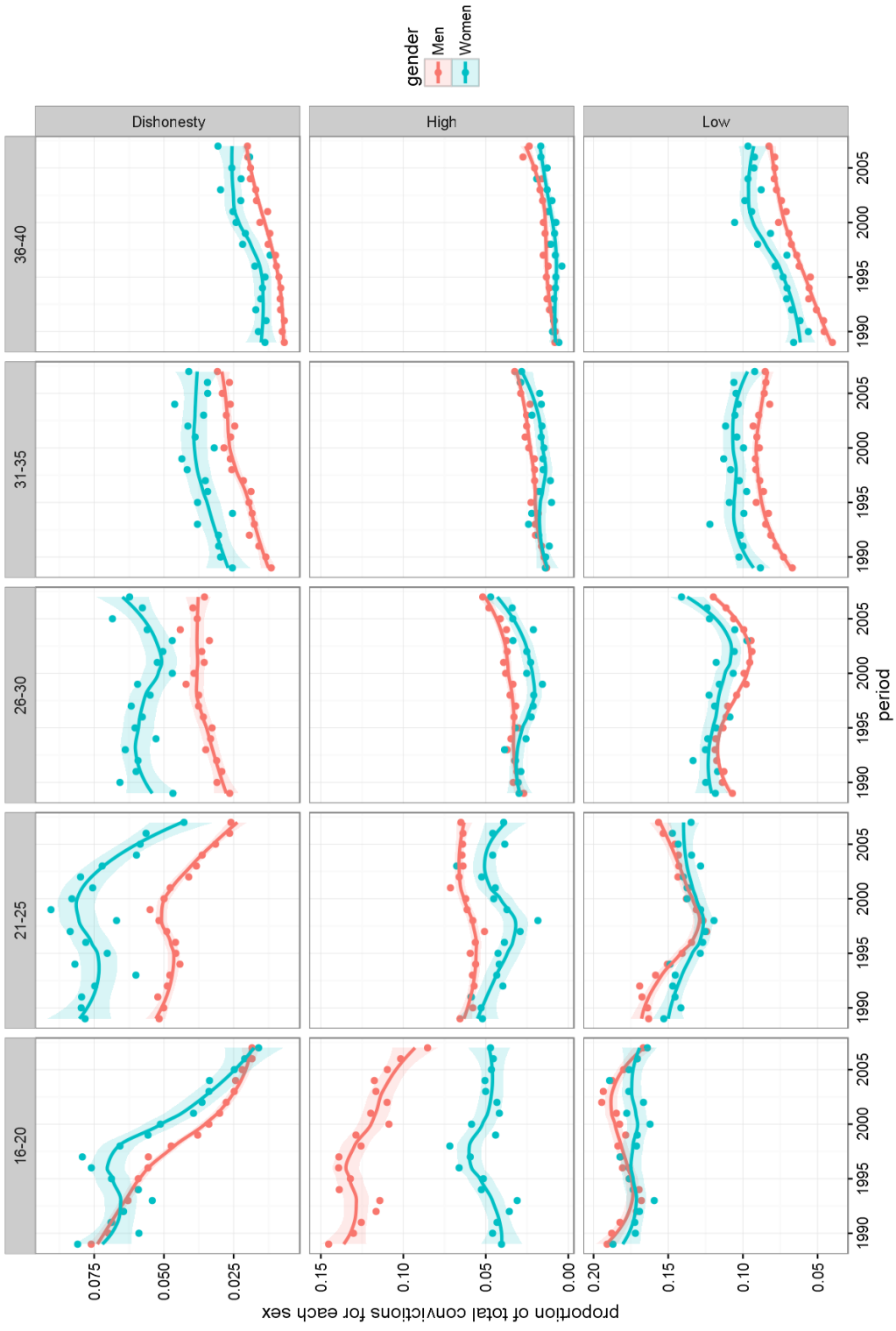

Figure 8.10 Trends in proportion of total convictions attributable to different latent classes in different ages

curve as seen in Chapter Six – as well as a more even distribution across groups of offender, as defined by the LCA model estimated here.

Polarisation and the crime drop

Drawing together this analysis of polarisation over the course of the crime drop, the picture presented by this analysis is one of contrasting trends for different ages. As in previous studies (von Hofer 2014, Bäckman et al. 2014), the proportion of the convicted population made up by low-rate offenders, understood here as members of the Low latent class, has increased over the course of the crime drop. This is due to a declining membership of the Dishonesty class, as the proportion assigned to the High class shows no change for men aged 16-20 and marginal increases for women of this age. A similar picture is seen for those aged 21-25, albeit with a later timing of change. For those over the age of 26 an opposite trend is observed, with the proportion of men and women of this age assigned to the Low class decreasing for most age-bands.

The results presented here agree with the contention of Berg et al. (2016) that policing strategies and formal sanctioning mechanisms, such as imprisonment, are unlikely to have contributed to falling conviction rates, as such sanctions would be expected to impact primarily on high rate offenders. As measured by membership of the High class, this has not been the case in SOI. One possibility is that the actions of the justice system may have particularly affected the people who the LCA grouped together into the Dishonesty class. However, as discussed in Chapter Two, LCA results should not necessarily be interpreted as relating to discrete groups of people, and it should be remembered that this analysis did not aim to test the impact of policing strategies or imprisonment rates on conviction rates. It may be that the falling number of convictions served to the High and Low groups also reflect fewer convictions for dishonesty; if all classes were affected equally by falls in crimes of dishonesty this would still have a larger effect upon the Dishonesty group due to the high prevalence of convictions of dishonesty within this group. Consequently, larger relative declines in the membership of the Dishonesty class could represent a general process that affects crimes of dishonesty across all classes. The possibility of such a general effect suggests the importance of examining change in different types of crime for different classes. It is to this question that the focus of this chapter now

turns.

8.4 Using LCA to examine the generality of declining convictions across types of crime

This section examines trends in the proportion of convictions for different crime types served to different latent classes. First, figures are presented for all ages. Following this, trends are presented for different age-bands separately. Given the importance of falls in the membership of the Dishonesty class presented so far, discussion of trends concentrates on trends for crimes of dishonesty, but results are presented for all crime types.

Convictions for different types of crime across latent class groups

Figure 8.11 presents change in the proportion of convictions of different types over time. Proportions sum to one for each crime type across latent classes, indicating the distribution of convictions of different crime types across latent classes (i.e. they sum down columns). This graph is divided by gender and convictions class. Men are shown in the left hand column and women on the right hand column, with classes in the order Dishonesty, High and Low running from top to bottom. Different types of crime are marked by the different coloured lines, which once more show values smoothed with a *loess* curve.

Focusing on crimes of dishonesty, this figure suggests that for men and women the crime drop is reflected in a mostly even reduction in crimes of dishonesty across conviction classes – including the dishonesty class. Crimes of dishonesty are shown by the turquoise line. Indeed, Figure 8.11 shows that falls in convictions of dishonesty are proportionally greatest for the Low class for both men (from 39% of crimes of dishonesty in 1990 to 33% in 2007) and particularly for women (50% in 1989 to 40% in 2007). This change is mostly offset by increases in the proportion of convictions for dishonesty for the High rate class, which increase from 30% to 36% for men and for around 10% to 18% for women. Despite the falls in membership of the Dishonesty class described above, this class contributes a reasonably consistent volume of total crimes of dishonesty for men, at just about 31% of all convictions for crimes of dishonesty in both 1989 and 2007. The dishonesty class contributes a marginally *increasing* proportion of convictions for dishonesty served to women, increasing from 38% in 1989 to around 42% in 2007. These results suggest that the

fall in crimes of dishonesty has affected *all* convictions classes, and indeed has led to a higher proportional reduction in convictions for dishonesty served to the Low class than the Dishonesty class.

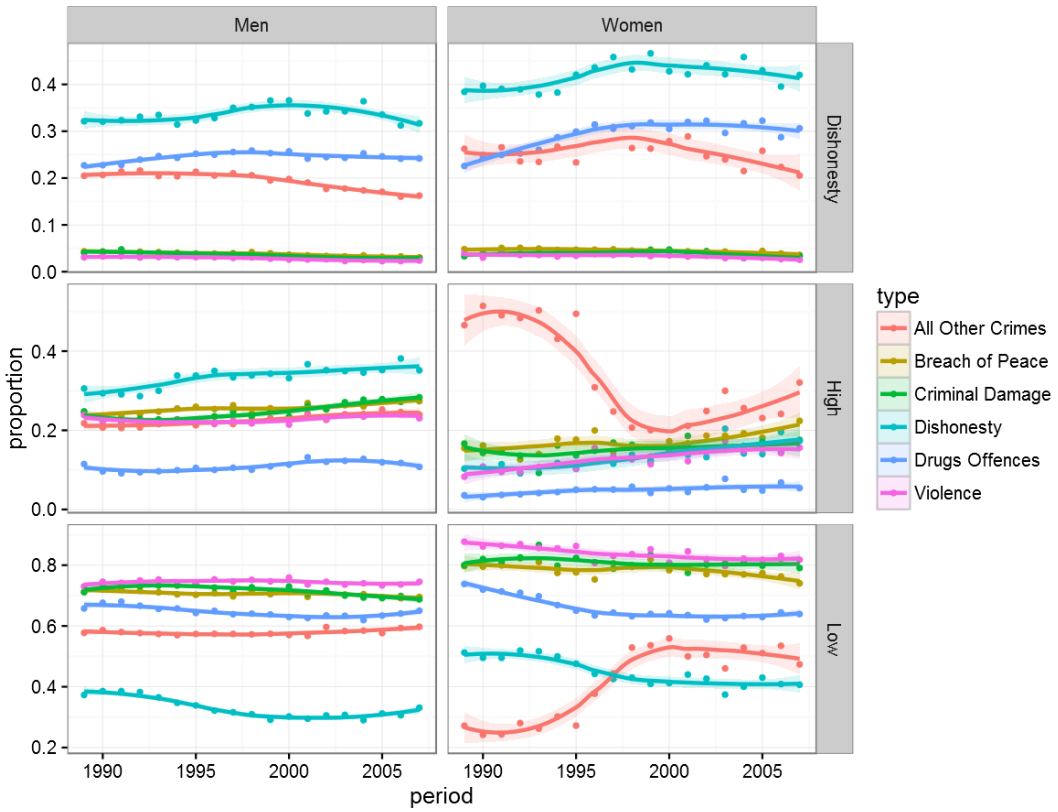

Figure 8.11 Change in the proportion of convictions for different crime types and latent classes

This general effect of falling crimes of dishonesty explains why membership of the Dishonesty group declines over time at a greater rate than other groups; at the start of the period covered by SOI the LCA could more easily identify people with convictions for dishonesty but not for other crime types. Because crimes of dishonesty have declined – but convictions for other crime types have shown comparatively little change – by the late 2000s the group which is dominated by crimes of dishonesty is less helpful when describing overall patterns of convictions, and so is less populated by the LCA.

These results also suggest that thinking of the members of this Dishonesty group as a distinct *class* to other offenders may be misleading. The substantial fall in the

membership of the Dishonesty class seems to have little to do with the characteristics of the people in this class as distinct from people in other classes, and more to do with the *type of crime* that dominated this class. This is an important substantive distinction. This finding suggests that the fall in the membership of the Dishonesty class is best understood as part of a general process affecting all convictions classes. Once again, this means that falls in the membership of the Dishonesty class are unlikely to be explained by the actions of the police or the justice system in targeting a particular group of people (Berg et al. 2016, MacLeod et al. 2012), but rather that there is a general mechanism leading to falling convictions across convictions classes.

This finding also helps to provide context to the observation of Soothill et al. (2008:91) of "smaller numbers of convicted offenders but with more (and more varied) convictions" as convicted in courts in England and Wales between the late 1970s and the late 1990s. Soothill et al.'s observation is based on falling proportional membership of single-offence clusters identified by LCA, and these clusters primarily related to acquisitive crimes[133] (2008:87). The fall in the membership of the Dishonesty class – the class identified which is dominated by acquisitive crime – therefore represents a similar observation in SOI. However, Figure 8.11 suggests that lower membership of these acquisitive crime classes is due to a general process of falling dishonesty that affected all convictions classes. As a result, people convicted may appear more versatile *on average* in recent years because falls in convictions have been concentrated in a single, large, crime type (crimes of dishonesty). Whilst it should be noted that the time period covered by Soothill and colleagues differs from that considered in the current analysis, increases in the variety of convictions served to those who are convicted as seen by Soothill et al. may be best explained by a compositional effect – i.e. by the subtraction of crimes of dishonesty – rather than that the people convicted as individuals are committing an wider variety of crimes. Such a compositional effect would explain why the results presented here have not shown much evidence of an increased frequency of conviction as suggested by Soothill et al.

For other crime types the most striking trend is the curvilinear pattern in the proportion of All Other Crimes and Offences served to women. This shows a sharp[134]

133 The "versatile acquisitive" class identified by Soothill et al. (2008:87) also shows sharp declines between 1973 and 1978 birth cohorts.

134 A fall of 45% of the convictions for All Other Crimes and Offences served to the High class in 1994

drop in the proportion of convictions for this crime type served to the High class after 1994. That the Low class shows an opposite trend of a sharply increasing proportion of convictions for All Other Crimes and Offences, shows a displacement of convictions for this crime type between the High and Low classes. Linking back to the results of Chapter Six, which showed a very high frequency of convictions for All Other Crimes and Offences for women between 1989-1998, suggests that the women with this high frequency of convictions for All Other Crimes and Offences are being included as members of the High class by the LCA[135]. This provides an example of the heterogeneity that exists even within these classes constructed by the LCA, and emphasises that the *meaning* of membership of these classes (that is, what these latent classes are measuring) can vary at different times and between men and women.

Change in the number of convictions of different types by gender and age

Extending this analysis further, Figure 8.12 compares change in the concentration of convictions for dishonesty between men and women of different age bands. To provide the most direct comparison between classes this figure controls for the differences in proportions of men and women of different ages assigned to different latent classes. Values are standardized so that the difference in the concentration of the proportion of crimes of dishonesty and proportion of people assigned to different latent classes for different age bands is equal to zero. What Figure 8.10 shows then is whether convictions for dishonesty served to men and women are becoming more or less concentrated into different latent classes, controlling for the size of the class. If values are greater than zero this represents an increasing concentration of convictions for dishonesty for that class for a particular age-band. This figure focuses only on crimes of dishonesty given their importance to the fall in convictions across latent classes as described in this chapter. Figures which show trends for all crime types are included in Appendix 15, as well as trends in the raw numbers of convictions for different crime types. To help clarify the trends in the data the original values are again smoothed with a *loess* curve.

down to 30% in 1995.

135 As shown in Appendix 12 there is a sharp drop in the frequency of convictions for prostitution served after 1998. This change in convictions trends for prostitution most likely explains the unusual trend for convictions for all other crimes and offences seen in the High-rate latent class.

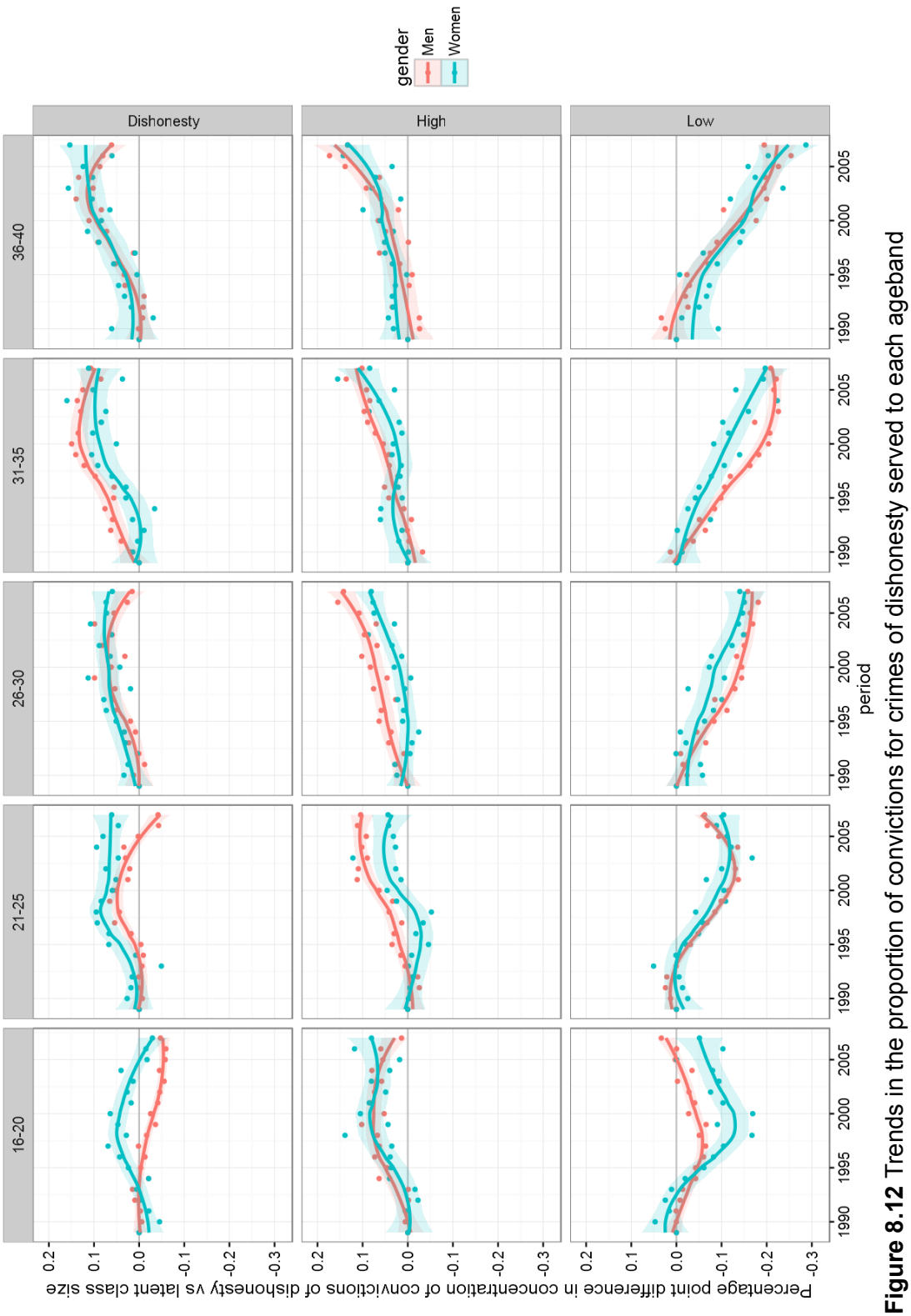

Figure 8.12 Trends in the proportion of convictions for crimes of dishonesty served to each ageband

These results show that for the majority of age-bands men and women show very similar trends in how convictions for dishonesty are divided between latent classes. For ages 26 and above convictions of dishonesty are becoming decreasingly concentrated in the Low class, and are becoming more concentrated into the High and Dishonesty classes for both men and women. For the 21-25 age-band convictions for dishonesty are also less concentrated in the Low class. For men convictions for dishonesty are displaced from the low class into the High class, with the share of convictions served to the Dishonesty class first increasing and then decreasing. For women, the share of convictions served to the Dishonesty and High classes both increase. For most age groups, and particularly for those age 26 and above, the crime drop has seen convictions for dishonesty move towards the High and Dishonesty classes, over and above the increases in the membership of the High and Dishonesty groups. This coincides with increases in the frequency of convictions for dishonesty described in Chapter Seven. A potential explanation for these trends may be that for these age groups securitization has had greater purchase in decreasing convictions for dishonesty amongst Low rate offenders, on the assumption that falls in crimes of dishonesty are attributable to securitization. It may also be that these results reflect a combination of securitization reducing convictions for dishonesty in combination with the presence of cohorts with particularly high convictions for dishonesty as discussed by Morgan (2014). Whilst the descriptive nature of this analysis does not allow a definitive conclusion as to the cause of these results, the results presented above suggest the value of further investigating potential differences in the impact of securitization amongst different age groups and potentially amongst people who offend at different rates.

Second, for the youngest age-band men and women show contrasting trends in the contributions of the Dishonesty class for convictions of dishonesty, particularly between 1989 and 1997. During this time the Dishonesty class for women contributes an increasing proportion of convictions for dishonesty, despite the size of this class falling over this period (see Figure 8.4). For men, the concentrated of convictions for dishonesty served to the Dishonesty class *decreases* over the same period. Note from Chapter Six, that these changes coincide with this first period of falling convictions that primarily reflect lower rates of crimes of dishonesty. Consequently, Figure 8.12 suggests that this period of falling convictions for

dishonesty affected men and women aged 16-20 in the Dishonesty class differently, decreasing the concentration of convictions for dishonesty to young men in this class but increasing it for women. This suggests that for young women the Dishonesty group was relatively less affected by any securitization process than the Low rate group. For young men, the Dishonesty group was particularly affected by securitization. This suggests that there may be gender differences in the impacts of securitization, although this suggestion can only be made tentatively. This results may also show again that the membership of latent classes represents different underlying patterns of offending by men and women, despite them being grouped into the same latent class; that, for example, the mix of offences included in the crimes of dishonesty category differs for women and for men.

Finally, Figure 8.10 indicates that the High class contributes an increasingly large proportion of all crimes of dishonesty for both men and women of all ages when controlling for changes in class membership. Whilst it should be noted that the absolute number of women assigned to the High class is very small, these trends provide another illustration that the mechanism which has reduced crimes of dishonesty has not done so evenly across all latent classes.

8.5 Discussion

The results presented in this chapter show important differences in trends across age and sex in the polarisation of convictions in Scotland. The presented above show that the High class comprised a steady proportion of all men convicted and an increasing proportion of women convicted. Compared with the results of Chapter Six, this suggests that for men, membership of the High rate class fell in line with overall falls in prevalence (see Chapter Six and Seven) whilst for women the numbers assigned to this class showed some decline but to a lesser extent than the prevalence of conviction for women. Whilst the proposition of "universal validity" that a small number of people contribute a disproportionate amount of offending (Weisburd 2015:149) can still be considered valid given the consistency in the relative size of the High class and its contribution to the overall volume convictions, the age mix of people who comprise this group (as identified by the LCA) has changed substantially. This contrasts with Owen and Cooper's (2013:20) finding that high-rate – or in their terms, 'chronic' – offenders declined in absolute numbers and

as a proportion of the cohorts born in 2001 and 2005. Moreover, these results add nuance to the examination of the contribution of 'chronic' offenders to the falling conviction rates by exploring trends for multiple cohorts and age ranges. Making these comparisons shows divergent trends across age, with an increasing number of men and women classed into the High rate convictions class at older ages contrasting with falls in the number (but not proportion) of young men and women grouped into this class. These contrasting trends over age suggest that the comparison of cohorts of people with a first conviction in 2001 and 2005, as conducted by Owen and Cooper (2013), may show falls in 'chronic' offenders in part because of changes in the age distribution of people convicted in England and Wales (Morgan 2014:22), as young people were more likely to be classified as 'chronic' offenders (Owen and Cooper 2013:13).

The results presented in this chapter support the idea of understanding the crime drop as a general process relating to crimes of dishonesty which has affected different groups of offender similarly. The caveat to this observation is that conviction trends across latent classes identified here differ over age and sex. This comes from the observation that, whilst the membership of the Dishonesty class falls dramatically, the proportion of convictions for dishonesty served to this class shows little change. This fall in the membership of the Dishonesty class, however, is concentrated in men and women aged 16-20. This finding reinforces the assertion made in Chapter Six that falls in convictions for Dishonesty during the 1990s represent age-limited effects acting primarily on young people. It is also possible that the increase in the membership of the Dishonesty class in particular also represents a cohort effect of men and women involved both in acquisitive crime and drugs offending (Morgan 2014). The impact of these effects is discussed at greater length in Chapter Ten.

It is also important to note that young women grouped into the Dishonesty class do not show the same falls in membership as young men during the 1990s. Chapter Six also showed that there was less of a fall in prevalence for crimes of dishonesty for young women during the 1990s when compared for men. Overall, this suggests that for young men the crime drop affected both those convicted for crimes of dishonesty at a low and high rate, whereas for women the effect was on those who committed

crimes of dishonesty at a low rate. This raises a question for the securitization thesis about why this might be. A potential answer may be that the Dishonesty class is measuring differs sets of actions for men and women in the same way that it appears to be measuring different things across age. This could be the case if women grouped into this class had a different profile of offending than men. However this is necessarily speculative given the descriptive nature of this analysis. Future qualitative research may be required to explore this issue in depth.

Finally, in demonstrating that the volume of total convictions is shifting away from high-rate young offenders, the results of this chapter echo those of Chapters Six and Seven which suggest that criminologists' focus should not solely be on adolescent offending (Cullen 2011, Sampson and Laub 1993), but should increasingly consider crime committed by those into their thirties and forties. The results presented in this chapter strengthen this suggestion by showing that people of these ages are increasingly being classified as High rate offenders and are contributing an increasing proportion of the total volume of convictions. This suggests that it is becoming increasingly important for criminologists to focus attention on these age groups (Cullen 2011).

8.6 Conclusions

This chapter aimed to assess the extent of the "polarisation" of convictions over the course of the crime drop in Scotland and to answer the question 'Has the distribution of convictions become more polarised over the crime drop in Scotland?' The results presented here suggest that there is no one comprehensive answer to this question. For young people there is little evidence of polarisation, with the Low offending class comprising an increasing proportion of all convictions over the course of the crime drop. This is in line with recent findings from Sweden (Bäckman et al. 2014, von Hofer 2014). For young people at least, the crime drop has led to both fewer offenders and a lower proportion of high-frequency offenders. However, this chapter has also demonstrated that the High and Dishonesty groups comprise an *increasing* proportion of people convicted over the age of 26, suggesting greater polarisation of conviction for these age groups. This serves to highlight the discrepancies across age in patterns of convictions over the course of the crime drop as highlighted in Chapters Six and Seven.

The analysis presented in this chapter has also demonstrated that differential trends in the membership of different latent classes represent a general process of falling convictions for dishonesty. However, this analysis also suggests potential gender and age differences in the patterns of conviction grouped together to form the Dishonesty class. These differences may explain contrasting trends in the contribution of this class to the overall volume of crimes of dishonesty.

Original contribution

The results presented in this chapter make an important contribution to the literature examining the polarisation of conviction over the course of the crime drop by exploring change across multiple cohorts of different ages at the same age period. This analytical approach identified diverging trends over age, and suggests results based on the comparison of cohorts focusing only on a single age-range may either be difficult to generalize if the age-range is small, or may disguise variation across age if the age-crime is large. This suggests that, where possible, divergent trends across age should be controlled for when examining change over time among different groups of offender in order to account for these potential age effects, and again highlights the value of SOI as a resource able to conduct this kind of analysis.

This analysis also has important implications for understanding the potential mechanisms influencing the crime drop. The results presented here emphasise the importance of crimes of dishonesty in lowering conviction rates for all latent classes, suggesting that the mechanism leading to these declines affects people who offend at low and high rates in a similar fashion. This is in-keeping with a mechanism such as improved security measures. However, the nuanced picture of differences between men and women of different ages and members of different latent classes suggests that further exploration of why a mechanism such as securitization would have these distinct trends for different demographic groups is required for the security hypothesis to be a convincing account of changing patterns of convictions in Scotland.

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This disparity over age seen in the results presented in this chapter raises an

important question: are these increases in membership of the High and Dishonesty classes for men and women of older ages due to people becoming increasingly likely to remain in high convictions groups over time? The following chapter investigates this question by extending the analysis presented here to examine trends in pathways of conviction over time.

Chapter Nine: Transitions between convictions classes and the crime drop

9.1 Introduction

This final results chapter focuses on change in pathways of conviction over time, extending the results of the latent class model described in Chapter Eight to describe movement between classes at different age bands and how these patterns of transition have changed over time. This answers the research question 'How have pathways between latent convictions groups changed over the course of the crime drop in Scotland?' In answering this question, the results presented in this chapter help understand whether increases in prevalence for those in their mid-twenties and thirties, as described in Chapter Six, are associated with people continuing to be convicted over longer periods, or whether they reflect convictions for those who have not previously been convicted.

To analyse pathways of conviction this chapter focuses on describing patterns of convictions in consecutive five-year age-bands – the same age bands used in the previous chapter to analyse polarisation. The analysis of this question is divided into two sections. The first section presents descriptive statistics for the data used in this chapter. This covers the number of transitions analysed over time and trends in the numbers of people with convictions in one or both age-bands at different ages. As the age-bands analysed run from ages 16-20, 21-25, 26-30, 31-35 and 36-40, the movement between these age-bands, movement between these age bands occurs at age 21, 26, 31 and 36. These ages are referred to as 'transition points'. Descriptive statistics provide an initial assessment of patterns of pathways of conviction, acting as a measure of persistence (convictions in both age bands), desistance (an age band with a conviction and then no conviction) and onset (no conviction followed by an age band with a conviction) of conviction over time. The second section expands these results to assess change in the proportions of people transitioning between latent classes as identified in Chapter Eight. This allows the analysis to establish whether general trends in persistence, onset and desistance hold for all groups identified in SOI. Doing so helps to assess whether the processes influencing persistence, desistance and onset are general or whether they only affect a particular

group.

As the scope of this analysis is limited to cohorts born before 1986 (see Chapter Four), this analysis cannot analysis trends in convictions pathways across the second period of falling convictions in Scotland after 2007 (see Chapter Six), as this the most recent year in which a person can transition into another age-band and have both periods classified in the LCA. This is an inevitable limitation of analysis of convictions patterns over long periods of time. As a result, the results of this chapter are particularly relevant to the period of falling convictions through the 1990s and increasing convictions through the early 2000s. This research strategy, then, is still able to explore increases in conviction for those 25 and above seen from 2000 onwards.

9.2 Descriptive statistics: Trends in desistance, persistence and onset

The numbers of desistance, persistence and onset transitions between 1994-2007 is presented in Figure 9.1. Different transition points are plotted as different coloured lines. The *x* axis shows the different years of the transition points, and the numbers of people making different transitions are plotted on the *y* axis. Raw figures are smoothed with a *loess* curve. The panels in the rows of the graph represent sex and the panels in the columns of the figure represent the different transitions.

Figure 9.1 shows that the different transitions have very different trends in the numbers of men and women making the different transitions. Starting with the 'desistance' transition, there are overall falls in the number of men and women who make 'desistance' transitions at each transition point between 1994 and 2007. That is, the number of men and women who have a conviction in one five-year age bands and then do not have a conviction in the subsequent five-year age band fell between 1994 and 2007. For the transition points at ages 26, 31 and 36 this decline is most pronounced after 1998, whilst for the first transition point (at age 21) declines in the numbers of men and women who make desistance transitions occur at a steady rate between 1994 and 2004. After 2004 there are increases in the numbers of both men and women who desist for the youngest two transition points.

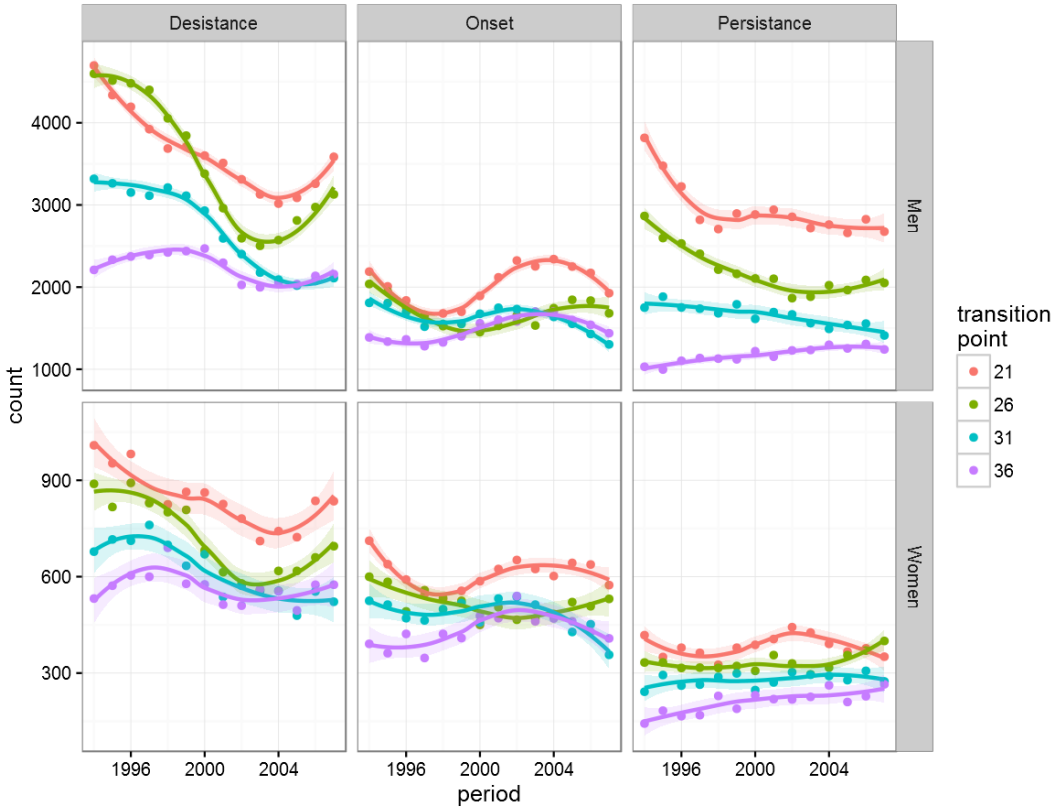

Figure 9.1 Number of people who desist, persist or onset in consecutive age-bands, 1993-2007

The trend in onset transitions is very different from the trend in desistance transitions, with much less decline in the number of people making onset transitions. While desistance transitions show the greatest decline between 1998 and 2004, onset transitions show the greatest increase during this period, with the exception of women at age 26, for whom numbers making onset transitions continue to decline from 1994 to 2002. For all transition points the number of people making onset transitions falls between the years 1994 and 1998 and then increases through the early 2000s. This is most pronounced for the first transition point at age 21, and particularly for men, with more young men with onset transitions at age 21 in 2004 than there were in 1994. This observation provides an indication that the increases in prevalence for those in their mid-twenties and above from the early 2000s as seen in Chapter Six are in part due to more people receiving their first convictions after their teenage years[136]. This observation supports the inference made in Chapter Six

136 This inference is particularly clear for those at the first transition point, for whom the conviction between the ages of 21 and 25 are necessarily their first convictions.

that increased convictions rates between 2000 were likely to represent the effect of net-widening.

Finally, the trends in persistence transitions show the most difference between men and women. For men there is a fall in the numbers who persist in convictions for the first three transition points between 1994 and 2007. For women it is only the youngest transition point which has fewer women persisting in 2007 than in 1994, with no steep decline in persistence transitions between 1994 and 1998 as seen for men. Comparing these trends with those for desistance transitions, for men and women falls in persistence are consistently of a lower magnitude than declines in desistance. When desistance transitions increase for the transition points at age 21 and 26 after 2004, there is no commensurate decrease in the number of persistence transitions. For men and women at the youngest transition point, persistence increases between 2000 and 2002 while the number of desistance transitions decreases. These trends indicate that *both* increased persistence and onset of conviction contribute to the increase in conviction rates for men and women between their mid-twenties and forties described in Chapter Six.

Whilst understanding trends in the raw numbers of people making desistance, persistence and onset transitions is a necessary first step to understanding pathways of conviction over time, assessing the proportions of men and women who make these different transitions can help to show which of these factors has shown a greater magnitude of change. In turn, this can indicate whether desistance, persistence or onset has a greater relative importance in influencing overall conviction rates.

Proportions of men and women who make different transitions

As discussed in Chapter Four, there are two ways to calculate the proportion of people making different transitions across transition points: first, as a proportion of people with a conviction in the first age-band (that is prospectively); and second, as a proportion of people with a conviction in the second age-band (retrospectively). In particular, analysis only concentrating on those with a conviction in the first age-band of an age-band pair provides a prospective view of what happens to people after they have a conviction. This provides the most helpful measure of desistance

and persistence. Examining where people with a conviction in the second age-band of an age-band pair have come from provides a retrospective view of how people arrive into convictions groups. This view provides a measure of onset, but gives less traction as a measure of persistence. By comparing trends in persistence across prospective and retrospective transitions gives an indication of the relative impact of persistence and onset in increasing conviction rates.

Prospective transitions

Figure 9.2 shows the proportion of people who desist and persist after receiving a conviction in the first age-band of an age-band pair[137]. The figure is presented by gender (columns), and transition (rows) with each line representing a different transition point. As in Figure 9.1 year runs along the *x* axis, with the proportion of people convicted who make different transitions presented on the *y* axis. Different transition points are represented by different coloured lines. Again, a *loess* curve was fitted to highlight the trends in the data.

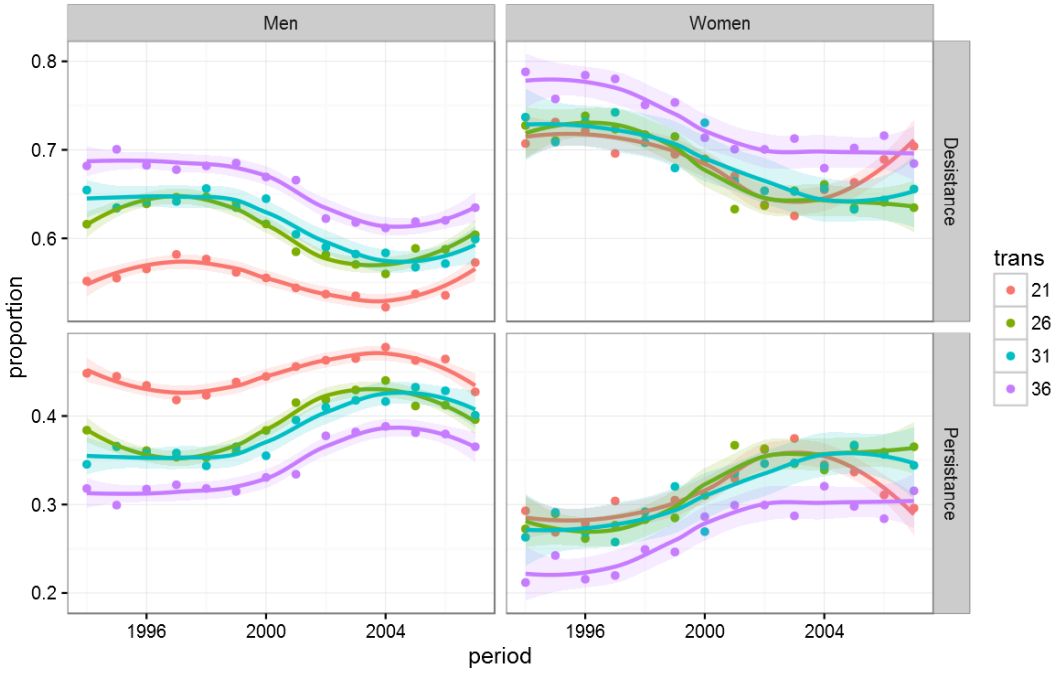

Figure 9.2 Proportion of people with convictions in consecutive age-bands, 1993-2007

Figure 9.2 show substantial similarity in trends both between men and women and

137 As a result, there is no trend presented for Onset transitions.

between different transition points. The proportion of people making different transitions is mostly stable until 1998, at which point the proportion of men and women making desistance transitions declines and the proportion making persistence transitions increases. This trend peaks in 2004, at which point the proportion of men of all ages making persistence transitions declines. The proportion of women making persistence transitions at the youngest transition point also declines after 2004, but there is little change for women at older transitions points. These results confirms that increasing persistence in conviction contributed to the increase in prevalence of convictions for those 21 and older through the early 2000s, as seen in both Chapter Six and Chapter Eight. This conclusion is supported by the observation of *increases* in the proportion of persistence transitions between 1998 and 2004, reflecting the findings of Figure 9.1 that falls in desistance were of a greater magnitude than decreases in persistence. This increase in persistence transition indicates that high increased prevalence of conviction for those in their mid-twenties and older (as seen in Chapter Six) does not simply reflect cohorts with a high prevalence during their teenage years in the early 1990s filtering through the justice system at the same rate as previous cohorts. Put another way, this suggests that increases in prevalence seen in Chapter Six represent people staying in contact with the justice system for longer, not just more people coming into contact with the justice system. Again, this period of increasing persistence coincides with the 'punitive turn' in justice policy as described by McAra (2016)[138].

Figure 9.2 also shows that this increase in persistence is of a similar magnitude across age, with all age-bands showing an increase in the proportion of people persisting in convictions across transition points of between five and eight percentage points. Moreover, the trend in increasing persistence is distinctly non-linear, echoing the finding of Figure 9.1. For men, this increase in persistence occurs quite sharply in the late 1990s and peaks for the transition point in 2005 before declining. For women the picture is less distinct over age, with an upward trend from around 1997 to 2003. There is a fall in persistence for women at the youngest transition point at the same time as men (after 2004). However, this trend is less apparent for transitions at ages 26 and 31, and the oldest transition point for women

138 Whilst this increase begins in 1998 and ends in 2002/2003, it should be remembered that these transition points relate to ten years' worth of data, and the year listed in Figure 9.2 is the mid-point of these ten years.

shows a flat trend from 2002. The overall picture presented by Figure 9.2 is of increasing persistence and falling desistance between 1998 and 2004, with desistance transitions increasing again for all men and for women at the youngest transition point between 2004 and 2007. The similarity in the magnitude and timing of these changes for all age groups are most in-keeping with a period effect as discussed in Chapter Four, as such effects are anticipated to affect all age groups in the same year. This also provides support to interpreting these effects as a system effect (see Chapter Three).

Retrospective analysis

Figure 9.3 presents the proportion of people who have a conviction at either age-band in any pair of age-bands using the second age-band as the base (i.e. defined retrospectively). The layout of this figure is the same as Figure 9.2, with the exception of the addition of trends in onset pathways that are not included in Figure 9.2.

Figure 9.3, like Figure 9.2, shows the proportion of people making desistance transitions at different age-bands falling, with the same curvilinear pattern shown in Figure 9.2. During the early 2000s there was a decline in desistance transitions, as a proportion of people who had a conviction in either age-band of an age-band pair, for men and women of all ages. The magnitude of this decline ranged between 7 and 10 percentage points. This fall in desistance transitions when considering also suggests that attrition in SOI caused by migration has not affected the substantive results; as discussed in Chapter Four, the potential impact of migration on the appearance of desistance in SOI would be to *increase* desistance transitions if people were convicted and then subsequently left Scotland. However, Figure 9.3 and 9.2 both show falls in desistance transitions. Moreover, similarities in trends across age also suggest that population change has not substantially affected these trends, given that Chapter Seven showed population change is necessarily distributed very differently over age.

In contrast to this fall in desistance transitions, the proportion of those making onset transitions increased in the early 2000s for men and women of all ages, although the magnitude of this increase is lower for younger women (around 2 percentage points)

than older women (around five percentage points). Increases in the proportion of men and women making onset transition are between 5 and 7 percentage points for all age bands. As discussed in Chapter Four, for increased migration into Scotland to affect patterns of onset, such effects would occur after 2005 and be particularly concentrated amongst those under 25. Whilst in these results there is a trend of increasing onset transitions between 2000-2005, and as these years denote the middle-point of a ten-year span (see Chapter Four) increases in migration into Scotland could conceivably contribute to this trend, as the increase in onset is seen across all age bands it seems implausible that this trend is caused by changing migration patterns.

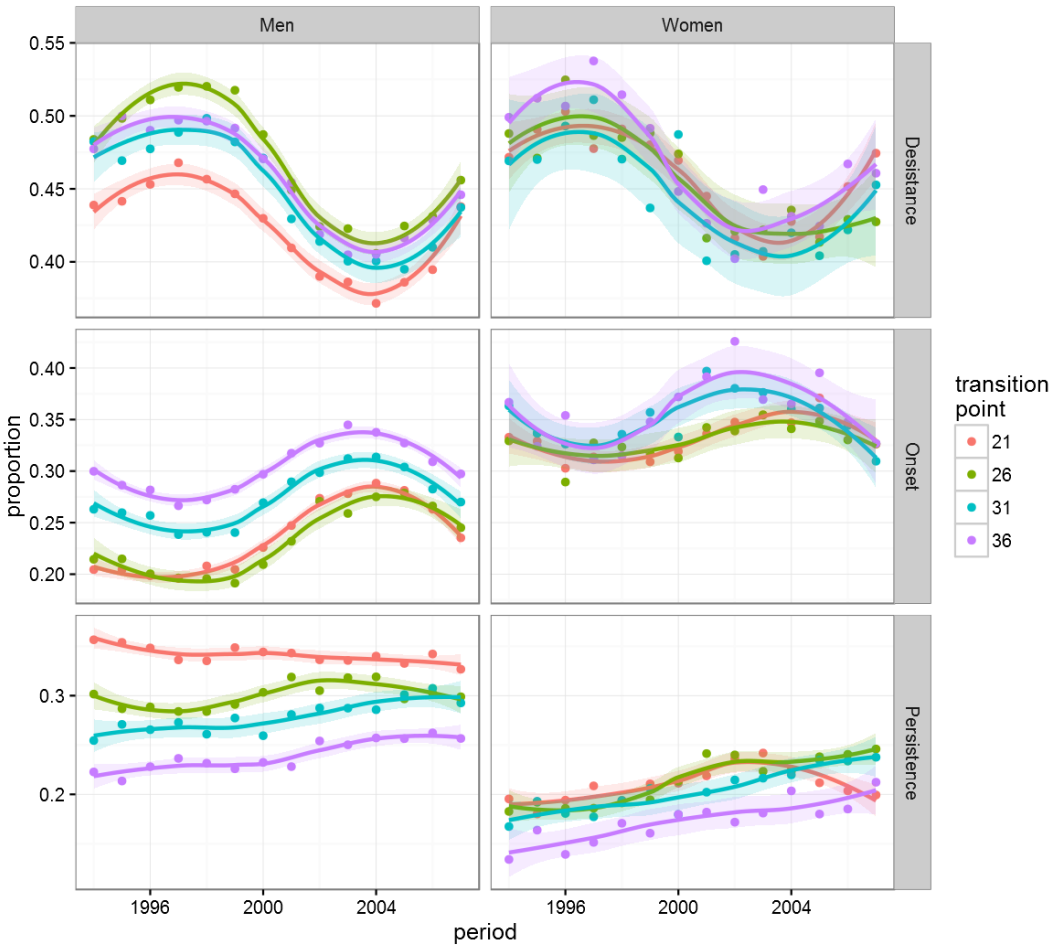

Figure 9.3 Proportion of people who desist, persist or onset in consecutive age-bands, 1993-2007

Crucially, Figure 9.3 shows a very different trend in persistence than that presented in Figure 9.2. For the youngest men, the proportion who persist shows a steady *decline,* compared to increase in persistence transitions seen in Figure 9.2. However, increases in persistence are seen for men at the second (age 26), third (age 31) and fourth (age 36) transition points. For women, the second and fourth transition show similar trends to the equivalent transition points for men. However, for the youngest transition point men and women have quite different trends, with women showing a steady *increase* between 1994 and 2002 in the proportion persisting, followed by a steady decline thereafter. This difference in trends illustrates that for men increases in onset transitions were of sufficient magnitude to mask the effect of increases in persistence when the proportion of transitions are calculated retrospectively. However, for women at the first transition point, increases in persistence were of sufficient magnitude between 1998 and 2004 that they were not obscured by the increases in onset transitions seen for women at transition point one. Starting from the perspective only of those who have a conviction in the first age-band of an age-band pair (or, in other words, a prospective view) shows an increase in the proportion of people who are convicted in adjacent age-bands. When those who have convictions in both age-bands are included (a retrospective view) in the analysis there are notable increases in the proportion of onset transitions. For young men in particular, this increase in onset pathways is of sufficient size to obscure the increases in persistence shown in Figure 9.2. Table 9.1 illustrates these trends by comparing the proportion of men and women making persistence and onset transitions at age 21 in 1998 and 2004. The increases in persistence for young men, which are of a similar percentage point increase to those for young women when measured prospectively, are almost entirely obscured when measured retrospectively. This illustrates the greater magnitude of onset at age 21 affecting men as compared to women.

Drawing these results together, whilst both onset and persistence increase for men and women, for men the relative increase in onset is much larger than the relative increase in persistence. For women the relative increase in onset and persistence is very similar. The results presented so far have also shown that increases in the number of people between age 25 and 40 convicted between 2000 and 2007, as outlined in Chapters Six and Eight, are due to both increasing persistence transitions

(and therefore a declining proportion of people making desistance transitions) *and* increasing onset transitions. These effects are only able to be observed by longitudinal analysis, and, as discussed below, expand upon the results of the cross-sectional analysis presented in Chapter Six. This highlights the flexibility of SOI as a data source and the research design adopted in this thesis, in being able to consider both longitudinal and cross-sectional perspectives.

Table 9.1 Comparison of the difference in the proportion of men and women making different transitions between 1998 and 2004.

Perspective	Sex	Persistence	Onset
Prospective	Men	+5.45	-
	Women	+6.19	-
	Difference (men-women)	*-0.74*	-
Retrospective	Men	+0.48	+8.03
	Women	+3.13	+3.21
	Difference (men-women)	*-2.65*	+4.82

Note: Figures represent percentage point change between 1998 and 2004. Source: SOI.

Implications of Change in Persistence, Desistance and Onset

This analysis adds important nuance to the results observed so far in this thesis. First, the timing of these increases in persistence and onset of convictions align with the period of increases in total between 2000 and 2006 (see Chapter Seven). This provides further evidence that this period of increasing convictions should be seen as distinct from the period of falling convictions during the 1990s – when persistence and onset show very little change – and also the second period of falling crime rates after 2007. Whilst these differences in trends do not necessarily require different causal mechanisms, attempts to explain trends in convictions patterns in Scotland must be able to account for this period of increase as well as the times of decrease which surround it. Interpreting these increases in onset and persistence as period, and hence system, effects suggests that the magnitude of the effects of net-widening and recycling may have been different for men and women in this period. Specifically, these results suggest that women in their early twenties may have been affected by increases in *recycling* in the justice system in Scotland between 2000 and 2007 more than men. This is inferred from the greater increase in persistence transitions for young women compared to young men. It should be noted though that both young men and young women showed increases in persistence and onset

transitions, suggesting possible effects of recycling and net-widening *at the same time*.

Based on Figures 9.1, 9.2 and 9.3 it is not possible to assess whether these changes in persistence and onset are related to the changing mix of crime types of which people are convicted in more recent years. If those convicted of crimes of dishonesty were particularly prone to desist, removing these people from the convicted population may lead to the observation of proportional increases in persistence. Another explanation may be that low-rate offenders were being diverted away from the justice system, leaving those more likely to persist (see Francis et al. 2007). This compositional explanation seems implausible for two reasons. First, those convicted for crimes of dishonesty typically have higher rates of reconviction than those convicted of other crime types (Scottish Government 2016b)[139]. Second, it is only the youngest age groups which saw falls in prevalence convictions for dishonesty (see Chapter Six), but all ages show similar increases in onset and persistence in Figures 9.2 and 9.3. If this increase in persistence was due to a compositional effect, increases in onset and persistence should only be seen at the youngest transition point (i.e. across the age bands which see falls in crimes of dishonesty throughout the 1990s in Chapter Eight). Moreover, such an effect would only affect the *proportion* of men and women persisting, rather than the *numbers* of men and women persisting (see Figure 9.1) which also increase during this period.

Together, the results presented in Figures 9.1, 9.2 and 9.3 imply a *general* process of increasing onset and persistence from 1998 to 2004 for men and women of all ages, albeit of differing magnitudes. As discussed in Chapter Four, this general trend across age suggests a period effect. Analysing patterns of transition across latent classes can show whether this general effect is seen across the convicted population. This analysis help investigate further whether changes in persistence and desistance are general effects, or whether they are affected some groups more than others.

9.3 Transitions between Latent Classes

The following section expands the analysis of persistence, desistance and onset

139 In addition, the work of Svensson (2002) and Owen and Cooper (2013) which highlight a positive association between convictions for dishonesty and a higher number of convictions suggests that such an explanation would be implausible.

presented above to explore trends in transitions between latent conviction classes over time. The first step in this process is to examine the overall trends in transitions between classes for all years. As the LCA presented in Chapter Eight identified some conviction classes that are very small, it may be that such small classes are not helpful to understand change over time in convictions if only very few people make those transitions. Examining the proportion of men and women who make different transitions can help determine which pathways between latent classes are likely to be fruitful for further analysis. After this overall analysis, trends in the proportions of men and women who make different transitions are presented in the same fashion as in Section 9.2.

Table 9.2 shows a cross-tabulation of membership of convictions classes in consecutive age-bands based on the LCA results discussed in Chapter Eight. As in Chapter Eight, figures are weighted by each person's probability of class membership at each time point. The table shows a matrix of transitions between the three latent classes and a 'no convictions' classification. The "total" row represents total numbers and proportions of class membership for different classes at age-band two, and the total column presents total numbers and proportions of classes in age-band one. Consequently, 'Persistence' transitions can be seen along the diagonal of the table and 'Desistance' transitions (from a convictions class to the no convictions class) are listed in the 'No Conviction' column. 'Onset' transitions are seen in the 'No Conviction' rows. The table presents the weighted numbers of men and women making different transitions (N) as well as the proportion of men and women making different transitions. Proportions are presented both as a proportion of the first age band (i.e. row percentages, looking at prospective transitions listed as %AB1) and as a proportion of the second age-band (column percentages, looking retrospectively listed as %AB2). As such, the rows of the table shows latent class membership in the first age-band of the age-band pair and the columns of the table show the latent class membership in the second age-band of the age-band pair. The table is further split by sex, with the figures for men presented above those for women.

For this analysis, the main value of Table 9.2 is to highlight that the numbers of people making different transitions differs substantially between men and women

and between classes, and with very small numbers of people making some transitions. In turn, this suggests that not all of these transitions are helpful in understanding overall trends in persistence, desistance and onset in SOI. These results are similar to the established canon of criminal careers research (see Chapter Two). For example, for most people (that is, those in the Low and Dishonesty groups) moving out of offending was the norm, as would be anticipated from the age-crime curve (Loeber and Farrington 2014). This can be seen in the prospective transitions from Low (65% of men and 73% of women) and Dishonesty classes (51% of men and 58% of women) For the High rate group, de-escalation from the High convictions class was the most frequent transition (44% of men and 40% of women). These results also illustrate Robins' paradox (1978) in the findings that the small number of people who persist in this class comprise a relatively large proportion of this class when analysed retrospectively (around 40% for both men and women), but a much smaller percentage when analysed prospectively (23% for men and 1% for women). These results also agree with Moffitt's (1993) observation that early onset and a high rate of conviction are related in the observation that very few men and women move into the High rate class from a period without a conviction (1% of men and 1% of women who had no conviction in the first age-band of the age-band pair).

The trends in pathways of conviction described in Table 9.2 are predominately consistent across age. In the interests of space results are not shown in full here (results are presented in full in Appendix 16), but comparing the proportion of people making different prospective transitions shows that only four out of the 120 possible transitions[140] have a discrepancy of five percentage points or larger between the proportion of people making that transition at a given transition point and the overall proportion of people making the same transition. This suggests that the overall transition proportions presented in Table 9.2 are a reasonably accurate description of patterns of transition at all ages. Of the discrepancies greater than five percentage points, all include men or women transitioning from the High or Dishonesty classes at the final transition point. Consequently, the variability between the transition proportions for these ages and the overall transition proportions is likely due to the small number of men and women assigned to these classes leading to fluctuations in their transition proportions. Again, this finding of

140 There are 15 possible transitions at each of the four transition points for both men and women, giving 120 total transitions (15 * 4 * 2 = 120).

Table 9.2 Numbers and proportions of men and women who make different transitions in SOI

Sex	Latent class assignment						
	Age-band one (AB1)		Age-band two (AB2)				
			Dishonesty	High	Low	No Conviction	Total
Men	Dishonesty	N	4,213	1,573	10,686	17,316	33,788
		% AB1	0.12	0.05	0.32	**0.51**	100
		% AB2	0.18	0.15	0.06	0.1	-
	High	N	2,660	4,334	8,375	3,513	18,882
		% AB1	0.14	0.23	**0.44**	0.19	100
		% AB2	0.11	***0.41***	0.05	0.02	-
	Low	N	8,701	3,882	67,291	147,938	227,812
		% AB1	0.04	0.02	0.30	**0.65**	100
		% AB2	***0.37***	0.36	0.39	***0.88***	-
	No Conviction	N	8,263	888	86,359	-	95,509
		% AB1	0.09	0.01	**0.90**	-	100
		% AB2	0.35	0.08	***0.50***	-	-
	Total	N	23,837	10,677	172,711	168,767	375,991
		% AB1	-	-		-	-
		% AB2	100	100	100	100	-
Women	Dishonesty	N	1,187	250	2,171	4,950	8,558
		% AB1	0.14	0.03	0.25	**0.58**	100
		% AB2	0.17	0.20	0.06	0.13	-
	High	N	280	289	652	414	1,636
		% AB1	0.17	0.18	**0.40**	0.25	100
		% AB2	0.04	0.23	0.02	0.01	-
	Low	N	1,943	506	9,606	33,056	45,110
		% AB1	0.04	0.01	0.21	**0.73**	100
		% AB2	0.29	***0.40***	0.26	***0.86***	-
	No Conviction	N	3,384	212	24,962	-	28,557
		% AB1	0.12	0.01	**0.87**	-	100
		% AB2	***0.50***	0.17	***0.67***	-	-
	Total	N	6,794	1,257	37,391	38,420	83,861
		% AB1	-	-		-	-
		% AB2	100	100	100	100	-
Total		N	-	-	-	-	459,852

Note: The total number of transitions here is 25 lower than number of transitions when analysed by most-likely class membership (figures not presented). Figures in Table 9.2 are scaled by the probability of latent class membership. This discrepancy is the accumulation of summing rounded figures during this process. Highest figure in each row presented in **bold**. Highest figure in each column in ***bold italics***. Percentages to 2d.p.. N to nearest whole. Source: SOI.

consistency across age in transition proportions is similar to existing criminal careers research, and in particular the results of Bartolucci et al. (2007) who found that a consistent transition matrix between latent classes of offender age 16 and above provided the best fit for convictions data in England and Wales.

So far this analysis has focused on average transition proportions across the whole period covered by SOI. Section 9.4 analyses how these transition proportions have change over time, drawing on the results of Table 9.2 to exclude transitions with very small numbers from this analysis. For prospective transitions, this involves examining the three persistence transitions (Dishonesty-Dishonesty, High-High and Low-Low), the three desistance transitions (Dishonesty-No Conviction, High-No Conviction and Low-No Conviction) and the two 'de-escalation' transitions (High-Low and Dishonesty-Low) and the escalation transition (Low-High). For retrospective transitions, focus is on the 'onset' (No Conviction-Low) and desistance (Low-No Conviction) transitions.

9.4 Change in transitions over time

Having described the patterns in the data overall, the final section of this chapter presents an analysis of change over time in the proportions of people moving between conviction classes. Given the large volumes of data involved, this analysis is presented for men and women separately. Results for the full matrix of possible transitions are included in Appendix 17.

Prospective transitions: Men

Figure 9.4 presents the proportions of men making different transitions between latent classes in consecutive age-bands. Proportions are calculated prospectively, and rows in this figure represent transitions from the same latent class in the first age-band. As a result proportions sum to one across rows. The top row shows proportions moving from the Dishonesty class, the second row those transitioning out of the High class and the bottom row the Low class. As with Figures 9.1-9.3, the different coloured lines represent transitions at different ages, with values smoothed using a *loess* curve.

Figure 9.4 shows important change over time in pathways between convictions classes, illustrating that the increase in persistence seen in Figures 9.2 and 9.3 is seen for all transition points for almost all persistence transitions. The notable exception to this trend is the fall in the proportion of men who persist in the Dishonesty class at age 21 after 2000. The results shown in this Figure 9.4 have a number of implications for the understanding of criminal careers over the course of the crime drop and add nuance to the findings described in previous chapters. Given this importance, results are discussed in detail below, focusing on transitions from each latent class separately.

Dishonesty

Of the three classes produced by the LCA, the Dishonesty class shows the greatest variation across age in trends in transition. This variation is due to the very different trend shown for transitions at age 21 when compared to transitions at older transition points. For the youngest transition point the proportion who desist remains close to 50% from 1994 to 2004. In contrast, this time span sees a small decline of around two percentage points for the proportion who move from the Dishonesty to the Low class. Different again, the proportion of those who persist in the Dishonesty class *increases* from 11.5% to 13% from 1994 to 2000. Note that this increased persistence covers a period when there were substantial falls in the numbers of men age 16-20 assigned to the Dishonesty class (Chapter Eight), and when falls in convictions for dishonesty were driving overall declines in convictions (Chapter Six). Figure 9.4 shows that persistence in the Dishonesty class does not decline at all during this period of sharply falling convictions for dishonesty. This observation has important implications for our understanding of the securitization thesis and its effect on criminal careers. During the 1990s those classified into the Dishonesty class at age 16-20 have an increasing likelihood of being grouped into this class again at age 21-25. If falls in convictions for dishonesty during this period are due to the effects of securitization, the observation of increasing persistence suggests the process of securitization has not led to increases the termination of criminal careers, as hypothesised by Farrell et al. (2011).

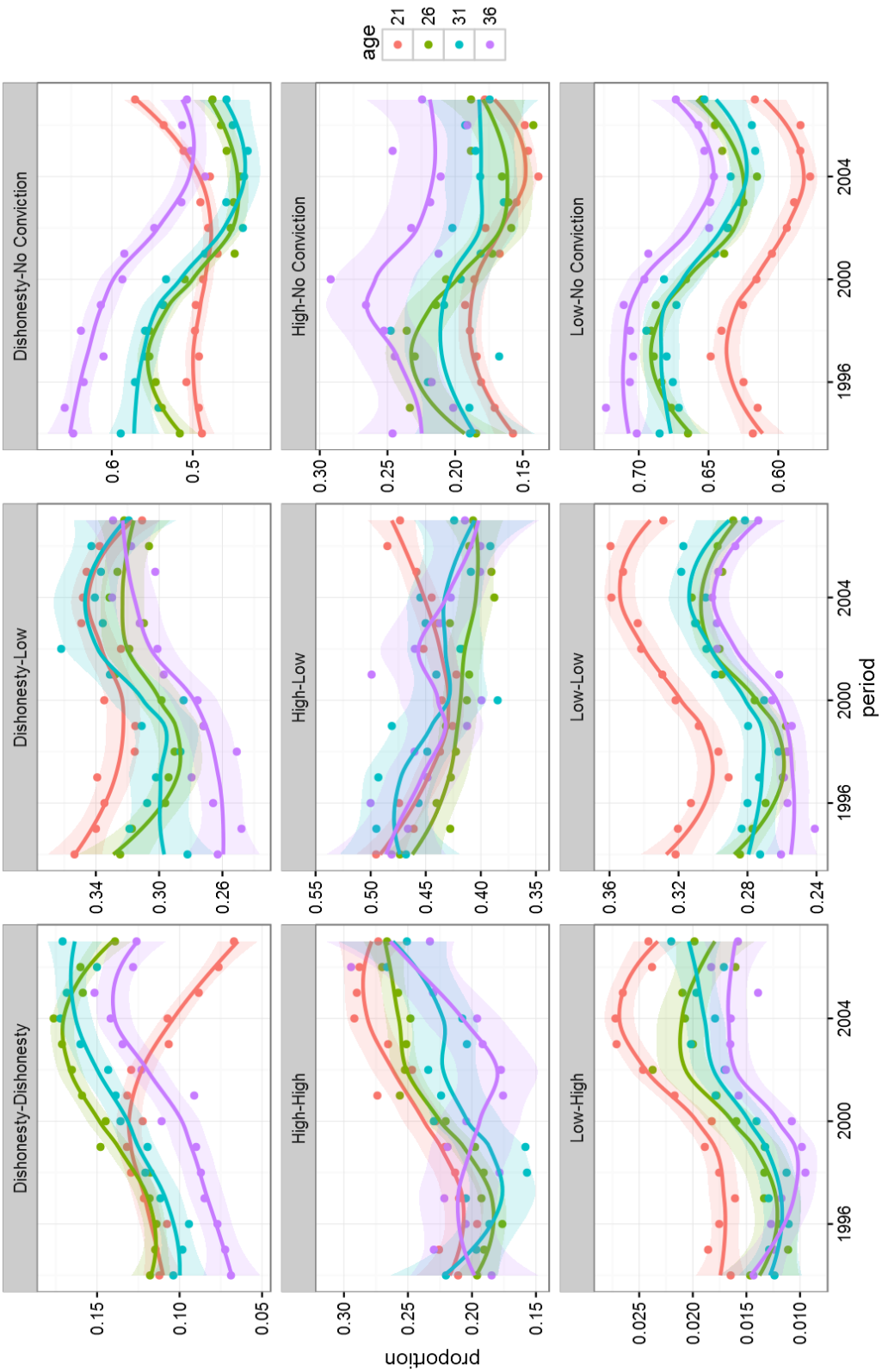

Figure 9.4 Proportions of prospective transitions by latent class, men

For older transition points, the falls in desistance from the Dishonesty class shown in Figure 9.4 are accompanied mostly by increases in the proportion who move into the Low class (increasing between four and six percentages points) but also by an increasing proportion of men who persist in the Dishonesty class (which increase by between five and seven percentage points). During the period of the crime drop during the 1990s when falling convictions were driven by lower prevalence of convictions for Dishonesty (Chapter Six), the proportion of men at ages 26, 31 and 36 who persisted in the Dishonesty class *increased*. This once again emphasises the difference across age in trends in convictions for dishonesty as seen in Chapters Six and Eight.

High

Trends in pathways out of the High rate class show more similarity across transition points than the trends in pathways out of the Dishonesty class. Given the small size of the High class there is also more variation in these trends, indicated by the wider confidence intervals around the *loess* curve. Starting with the desistance transition, for all ages there is a curvilinear pattern in trends for men desisting from the High rate group. There is an increase in the proportion of desistance transitions at all transition points from 1994 to 1998, and then falls in the proportion of men making this transition between 1998 and 2004. In contrast, the proportion of men who persist in the High offending group increases substantially (between four and seven percentage points) for all age groups between 1994 and 2007. The proportion of men persisting in the High class increases steadily for all transition points after 1996, with the exception of those transitioning between the oldest time-points, who do not increase sharply until 2002. This increase in persistence in the High rate class helps to explain the increasing proportion of men aged 26 and above classified into the High rate convictions class as seen in Chapter Eight.

The proportion of men who move from the High rate group into the Low class (or 'de-escalate') shows a steady decline throughout the period covered by SOI for the three oldest transition points. For the youngest transition point the proportion of men who de-escalate from the High rate class falls between the years 1994 and 2000 before increasing to 2007. By 2007 the proportion of men who de-escalate from the High class at age 21 is similar to the proportion who make this transition in 1994

(47% to 48%). As this is reduction in de-escalation at the youngest transition point is not accompanied by falls in the proportion of those who move into the High or No Conviction groups, this trend can be attributed to a lower proportion of men moving from the High rate group to the Dishonesty group at the first transition point. This transition is not displayed in Figure 9.4, but Appendix 17 confirms that this is the case.

The overall picture of transitions out of the High rate class is that desistance and de-escalation from the High rate group fall for men through the early 2000s, whilst persistence in the High offending class increases. This group of High rate offenders are those who would be particularly likely to be affected by any reductions in crime driven by formal sanctioning (MacLeod et al. 2012). Increased persistence for this group is in accordance with the conclusion of Berg et al. (2016) that falls in crime seem unlikely to have been caused by the actions of the justice system. These trends may also reflect greater recycling by the justice system which would be reflected in a higher proportion of high rate offenders (McAra and McVie 2010a). Increases in the proportion of men who persist in the High rate offending group may therefore indicate a greater effect of the justice system leading to longer periods with a high rate of convictions. That these increases in persistence occur between 1998 and 2005, spanning the "punitive turn" identified by McAra (2016) and are mostly consistent across age (with the exception of the last transition point) lends support to this interpretation.

Low

Of the three convictions classes identified, pathways out of Low class show the most similar pattern to those seen for the population as a whole (Figure 9.2), showing falls in desistance transitions and increases persistence transitions over time for all age groups. As with the High class, all four transition points show a similar curvilinear pattern for those who desist from the Low class, an opposite curvilinear trend for those who persist in the Low class. The proportion 'desisting' from this class falls from 1998 to 2004 before increasing again from 2004 to 2007. From 1994 to 1998 the youngest two classes show slight increases (around two percentage points) in the proportion of men desisting, whilst the proportion desisting at the oldest two age-points stay constant. There is, then, a marked fall in desistance – by more than five

percentage points – of people classified into the Low class between 1998 and 2004, but then a sharp increase again in desistance (by between 1.5 to two percentage points) between 2004 and 2007. This trend is similar across transition points. Those who persist in the Low class show an almost opposite trend to those who desist from this class, with a sustained increase in the proportion of people persisting in this class from 1998 to 2004 of between three and five percentage points for all ages.

The proportion of people who 'escalate' from the Low class into the High class shows a very similar trend to the proportion who persist in the Low class, increasing sharply after 1998 at all transition points. Once again, this implies a period effect leading to these changes. Despite the small numbers of men who make this transition, the increase in escalation is of substantive interest. The presence of this transition also cuts against the grain of the idea of consistent fall in offending with increasing age (Gottfredson and Hirschi 1990) although it should be noted that the numbers of men who make this transition are consistently very small (between 1-3% of transitions). In addition to those who persist in the High class, this transition best represents the potential effects of recycling through the justice system; people who are already in contact with the justice system but who move from a low rate of conviction to a high rate of conviction. The similarities in the timing of this increase in escalation and increases in persistence in the High class, which both show the greatest increase between 1999 and 2004 may suggest that the potential effects of recycling are broader than just those who have a high initial rate of conviction.

Prospective transitions for men: summary

Drawing these findings together, Figure 9.4 shows that all classes and transition points show falls in the proportion of men who desist, and particularly for older ages. This indicates that the fall in desistance transitions seen in Figure 9.1 is a *general* effect seen across convictions groups identified by the LCA, and across age groups. These results also demonstrate that the increase in convictions for older age-bands seen in Chapter Eight is in part due to increases in the proportion of people convicted who continue to be convicted over time. As a result, the increasingly even age distribution seen across latent classes in Chapter Eight reflects both a higher prevalence of conviction *and* increases in persistence of conviction. The increases in persistence pathways across latent classes suggest that the mechanism leading to

these increases in conviction rates for older adults is likely to be a more complex process than simply net-widening. This is because net-widening is anticipated to primarily affect low-rate offenders (Estrada et al. 2015). In contrast, these results show increases both in the persistence of those in the High rate class and in the proportion of people who 'escalate' from the Low to High-rate class over time. Again, this may indicate increased 'recycling' (McAra and McVie, 2010) of people in the justice system in Scotland between 1998 and 2004 at the same time as a net-widening effect. This would explain why men were more likely to persist in the High rate offending class, and why Low rate offenders were more likely (although in absolute terms, still unlikely) to become High rate offenders.

Prospective transitions: Women

Figure 9.5 presents the proportion of women making transitions out of different latent classes. This figure is presented in the same format as Figure 9.4, and as with Figure 9.4 results are discussed for transitions out of each latent class in turn. Due to the small numbers of women grouped into the High rate class, Figure 9.5 focuses only on transitions from the Low and Dishonesty classes. These small numbers also mean that there is greater volatility in these trends than those observed for men, as indicated by the confidence intervals around the *loess* curves.

Dishonesty

Similar to the results of Chapter Eight, Figure 9.5 shows differences across age in the pattern of change in pathways out of the Dishonesty class for women, although these discrepancies over age are less marked than those for men. Starting with the desistance pathway, the proportion of women making this transition falls by around 10 percentage points between 1998 to 2002. The youngest transition point then shows a sharp increase in the proportion desisting from the Dishonesty class between 2002 and 2007, which makes the proportion of young women who desist from the Dishonesty class almost the same at the end (59%) as the start (61%) of the period covered by SOI. For the three older transition points, the proportion of women desisting from the Dishonesty class do not show these increases.

Similarly, trends in women de-escalating from the Dishonesty class differs between the first transition point and older transition points. For the second, third and fourth

transition points the proportion of people de-escalating from the Dishonesty group shows an aggregate increase of around seven percentage points, primarily between 1998 and 2002. The youngest transition point shows a similar pattern of increasing de-escalation until 2002, when the proportion of women making this transition at age 21 begins to decline. Consequently there is little change (two percentage points) in the aggregate proportion of women making this transition at age 21.

Finally, the persistence transition also shows very different trends for women of different ages. All four transition points show aggregate increases in persistence of close to five percentage points between 1994 and 2002. At this point the proportion of women persisting in the Dishonesty class at the youngest transition point begins to decline, reaching the same proportion (12%) in 2007 as it held in 1994. The proportion of women persisting in this class at age 26 also falls, but this decline does not begin until 2005. In contrast, while there is much more variation in the proportions of persistence at the two oldest transition points, the overall trend as illustrated by the *loess* curve is of only a very slight decline, and as a result the overall change in persistence at these transition point is of increase between 1994 and 2007.

These diverging trends over age in transitions from the Dishonesty class also reflect the very uneven change across age in the proportion of women assigned to this class as shown in Chapter Eight (see Figure 8.4). In particular, the fall in persistence and increase in desistance from the Dishonesty class at the first transition point begins in 2002, just after the proportion of women assigned to the Dishonesty class at age 21-25 begins a sharp decline in 1999 (Figure 8.4). Consequently, Figure 9.5 indicates that this fall in women aged 21-25 assigned to the Dishonesty class after 2002 as seen in Figure 8.4 reflects both a change in the pattern of transition between classes as well as being a consequence of the lower number of women assigned to the Dishonesty class at age 16-20 (see Chapter Eight). This effect is similar to that described for men based on trends in Figures 8.4 and 9.4, except that for women this fall in persistence in the Dishonesty class begins in later than for men (in 2003 rather than in 2000).

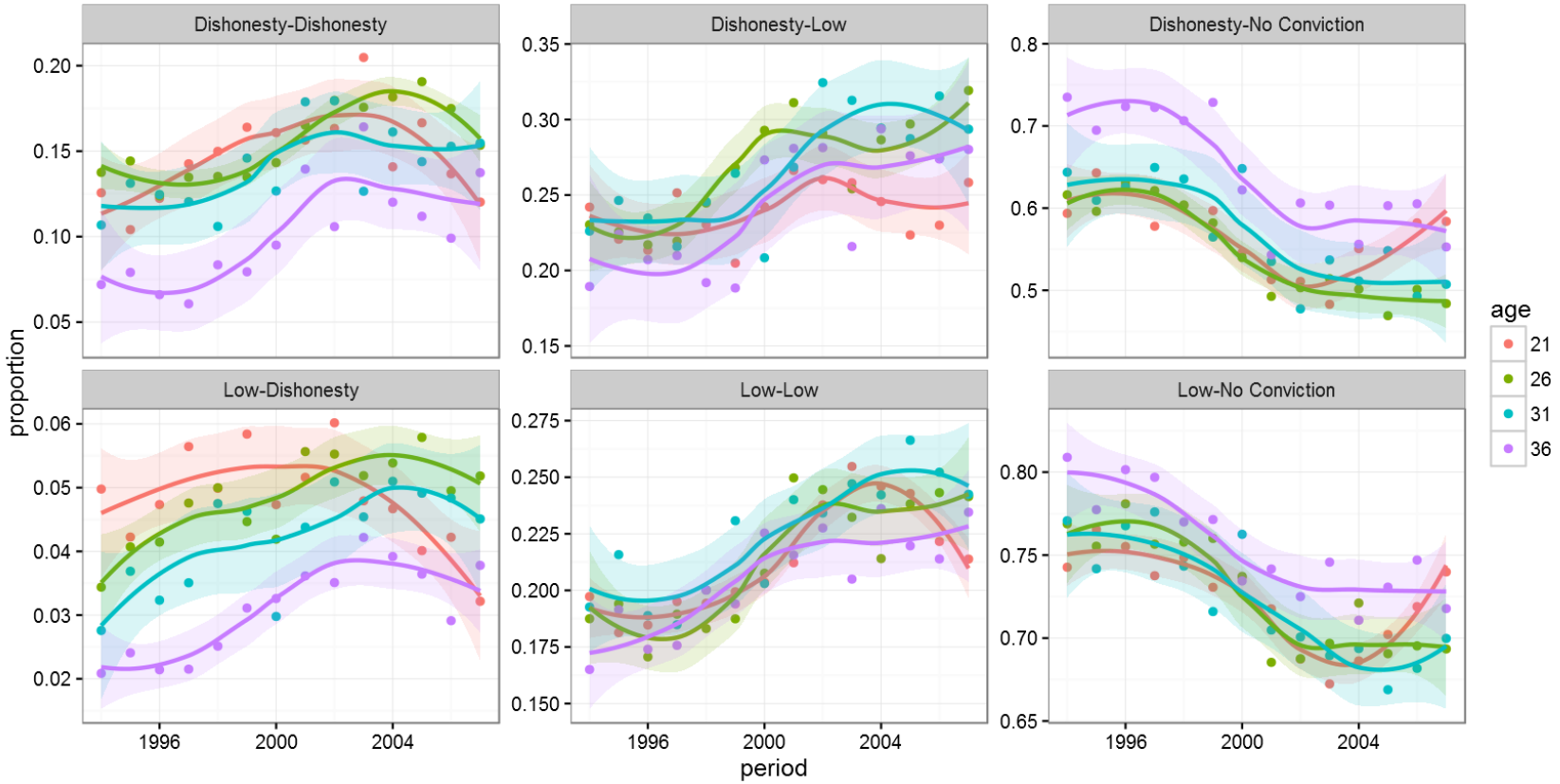

Figure 9.5 Proportions of prospective transitions by latent class, women

Low

The trends in transitions from the Low class show similar patterns for women as they do for men, with increases in persistence and falls in desistance. There is an overall decline the proportion of desistance transitions between six and eight percentage points for all transition points between 1994 and 2002. After 2002 the proportion of women making desistance transitions stays mostly stable for the three oldest transition point. In contrast, from 2004 the proportion who desist from the Low group at age 21 increases from 67% in 2003 to 74% in 2007.

This fall in desistance transitions from the Low group are offset by increases in the proportion of women who persist in the Low group. For all transition points, the proportion of women who remain in the Low group increases by between five and seven percentage points from 1996 to 2004. Acting as the inverse of those who desist, the proportion of women who persist in the Low class at the first transition point declines after 2004, whilst for older transition points the proportion remains stable. This suggests that the final period of crime drop between 2007 and 2011 is associated with increases in desistance *and* falls in persistence for young women, as well as declines in the prevalence of conviction as seen in Chapters Six and Seven.

The small numbers of women who transition from the Low to the Dishonesty class mean that inferences made from these trends must be made with caution. This acknowledged, the pattern observed in Figure 9.5 is of a consistent increase in proportion of women who move from the Low to the Dishonesty class between 1994 and 2004 for the three oldest transition points, which stabilizes between 2004 and 2007. For the youngest transition point the proportion of women who transition from the Low to Dishonesty class this transition shows little substantive change between 1994 and 2002 based on the *loess* curve, but after this point the proportion of women making this transition at age 21 declines. Again, this is a very similar trend to that seen for the persistence pathway for young women in the Dishonesty class. These similarities across age and latent class again demonstrate that the latent classes produced should be understood less as distinct groups of people and more as a summary of conviction trends for men and women of different ages in a given period.

Prospective transitions for women: summary

Figure 9.5 shows similar trends in pathways out of both Low and Dishonesty classes for women of different ages. Again, this emphasises that trends in pathways of conviction are general across classes. Importantly, women age 21 do not show the same trend of decline in persistence in the Dishonesty class at seen for men at age 21. For men the proportion who desist in this class falls from 2000 after a slight increase of around 2.5 percentage points from 1994 to 2000. In contrast, the proportion of women who persist in this class increases by roughly five percentage points from 1994 to 2003, and only then begins to decline. The proportion of women persisting in this class is also consistently higher than men. Even during period of greatest falls in the prevalence of convictions for dishonesty (Chapter Six), for women grouped into the Dishonesty class are *increasingly* likely to be grouped into this class in the subsequent age-band, and are also more likely to move from the Low class into the Dishonesty class. That these effects are greater for young women than young men again indicates that the latent class model is perhaps measuring something different for young men and young women. This observation reinforces the conclusion that, if falls in crimes of dishonesty are due to securitization, then they have not impacted young women in the same way as young men.

It is more difficult to make inferences about potential net-widening and recycling effects for women than it is for men because of the greater noise in the convictions data for women. This is due to the smaller numbers of women convicted, and is manifest in the wider confidence intervals seen in Figure 9.5 as compared to Figure 9.4. This acknowledged, the general upwards trend seen for transitions from Low to Dishonesty classes and persistence in the Dishonesty class at age 26, 31 and 36, and at age 21 until 2002, do suggest possible recycling effects. This timing coincides with the increases in onset and persistence transitions seen in Figure 9.3, again suggesting the interpretation of these results as both recycling and net-widening effects.

9.5 Discussion

The analysis presented in this chapter has shown important patterns of change in pathways of conviction between latent classes from 1994 to 2007. This analysis helps to better understand the increases in conviction rates for men and women in their

mid-twenties and older between 1999 and 2007 as first described in Chapter Six. Trends in conviction for men and women are very similar; higher conviction rates for adults in their mid-twenties to forties are due to both a higher proportion of people remaining in the justice system (persistence) and an increasing number of people moving into the justice system after periods with no convictions (onset). As a natural corollary to increases in persistence, both men and women show falls in desistance transitions over time, and of a similar magnitude to increases in persistence. However, there are differences between men and women in the relative importance of persistence and onset in driving increased convictions over the age of 21, with onset at age 21 increasing more than persistence for men, whereas for young women both persistence and onset show similar increases.

Understanding change in pathways of conviction

Changes in the pathways of conviction – declining desistance, increasing persistence and onset, predominately occur during the same period (1998 to 2002), across age and across sex. That these changes are evidenced across age and sex, and occur at the same time suggest a period effect. As mentioned in previous chapters, a period effect implies a system effect (Soothill et al. 2004). That this period through the early 2000s did not see increases in police recorded crime (Chapter Three) provides some additional weight to this interpretation of increasing convictions as a system effect, as does the observation that increases in convictions were seen across all types of crime (see Chapter Six). Moreover, there is little in the existing theoretical literature regarding criminal careers which would serve to explain increases in convictions between the late 1990s and the early 2000s; discussions of macro-level trends in crime have revolved around why crime (and convictions) have *fallen*, not why they have increased[141]. One implication of these results for theories of the crime drop, however, are to reinforce the observation from Chapter Eight that falling convictions appear to be a general phenomenon due to the similarity in trends seen across latent classes.

A further implication of this general effect relates to Farrell et al.'s (2015) suggestion that the crime drop is likely to relate to falls in Adolescent Limited (AL) offenders. If

141 As discussed in Chapter Four, it is possible that the mechanism driving this change has not yet been identified in the literature discussing the crime drop.

this contention is correct, and to the extent that SOI can act as a measure of adolescent offending[142], we would have expected two trends. First, there would be relative increases in persistence pathways at the first transition point, as the population of young people convicted would have increasingly comprised persistent offenders. Second, patterns of transitions at older transition points would either be unaffected or would only to be affected by cohort effects of formerly high rates of life-course persistent offenders (Farrell et al. 2015). Whilst the results presented here do show an increase in persistence pathways at the first transition point, this increase is also seen at the three other transition points at the same time. This implies a period effect leading to this higher rate of persistence, and so does not fit with the increase in AL offenders as described by Farrell et al. (2015). The similarity in transitions between latent classes also implies that these trends are a general effect and not one which has affected a particular group of offenders, and so further supports the view that this demographic shift is not due to declines in the prevalence of a particular group of young people who offend, such as AL offenders.

These observations combined suggest that these increases in persistence and onset may be best explained by the impact of system effects related to recycling and net-widening leading to greater persistence and greater prevalence of conviction. The observation of greater relative importance of persistence than onset for young women rather than men, and the inference that this is best understood as the effects of net-widening as opposed to recycling, is in contrast to the expectations of Estrada et al. (2015, citing Cohen 1985) that net-widening would more likely affect women than men. This trend cannot be explained by the greater falls in prevalence for young men, as Figure 9.1 identifies absolute increases in the number of onset transitions for both men and women. Part of this contrast may be due to the different phenomena being explored. Cohen's description of net-widening, upon which Estrada et al. (2015) draw, describes those with "fewer previous arrests, minor or no offences, good employment record, better education, younger, female—which all research suggests to be overall indicators of greater success" (1985:53) increasingly being made 'clients' of community and diversion programmes. The focus of the current analysis only on convictions in courts may perhaps explain why this assumed greater effect of net-widening for women did not hold in these

142 This capacity may be compromised in SOI due to left-censoring at age 16 (Chapter Four).

findings. In a sense, then, this analysis focuses on a different part of the justice system to that which Cohen refers. Based on the descriptive nature of the analysis presented here it is not possible to conclusively state why this discrepancy is observed. Further understanding of the impact of net-widening on overall conviction rates should explicitly account for differences between men and women of different ages in the effects of net-widening, and particularly regarding the potential effects of the "punitive turn" in Scottish justice policy. This is similar to the conclusion of McAra (2016) who identified statistically significant differences between men and women when modelling the decision to bring a person to a CHS hearing during the punitive era.

Comparison with findings from other countries

At this point it is worth noting again that the increases in convictions for those in their mid-twenties and over were not seen in the USA. Instead, in the USA Kim et al. (2015) and Farrell et al. (2015) saw increased arrests for those in their 40s, which Farrell et al. (2015) attributed to a cohort effect of high-prevalence cohorts filtering through the justice system. The contexts of the USA and Scotland are very different, and likewise Farrell et al. and Kim et al. draw on a different type of data to this analysis. This acknowledged, Farrell et al.'s (2015) explanation of change as relating to a cohort effect does not seem an accurate explanation of the trends observed here. Those who Farrell et al. (2015:9) observe as having higher arrest rates in their forties were "the offenders who began their careers in the 1970s and 80s when it was easy and tempting. Once into a criminal career, they likely found it harder to get out". The similarities in trends of increased persistence across cohort and age seen here imply a *period* effect, and so suggest that these effects were not due to increasing prevalence of conviction during an era of ease and temptation when particular cohorts were young as in Farrell et al.'s (2015) description. The capacity to make such comparisons across age and cohort illustrates the value of the research design adopted here, and the benefits of the longitudinal analysis of pathways of crime as opposed to the cross-sectional approach adopted by Farrell et al. (2015).

The contrast in findings between this study and results from the USA may be an indication that the increases in crime for those aged 26 to 40 are specific to Scotland, which in turn would strengthen the interpretation of these results as

reflecting a particular effect of justice system practices in Scotland during the early 2000s. As discussed in Chapter Six, this cannot be known without replication in another jurisdiction, and a move beyond simple-cross sectional analyses of the age-crime curve to explore longitudinal changes in conviction over time.

Justice system effects

The results displayed in this chapter reinforce Sampson's (2015) point that criminal careers research must pay attention to social institutional context. This analysis of pathways of conviction over the course of the crime drop in Scotland has identified increases in persistence and declines in desistance particularly related to the period between the early to mid 2000s. That the results identified here of increasing persistence and falling desistance here are best explained by system effects, given their similarities across age, sex and latent class, demonstrate Francis et al.'s (2004a) contention that changing institutional factors must be accounted for when working with convictions data. If these effects are indeed system effects as argued here, they illustrate that there are factors outside of people's control which affect their criminal careers (McAra 2016). Practically, analysis of criminal careers must be attendant to such factors, especially when working with administrative data. More importantly, the potential for net-widening and recycling effects must be acknowledged in justice system practice. This is discussed further in Chapter Ten.

Relating particularly to Scotland, at first blush the results presented in this chapter may appear to contradict the findings of McAra (2016), who found similarity across policy eras in Scotland in the factors predicting whether a person was called to CHS or court. In contrast, this analysis has highlighted distinctions between different policy periods in persistence of convictions in Scottish courts. These results can be reconciled with reference to the differences between research designs adopted; McAra shows (2016) a similar process for a single cohort at different ages. The results presented in this thesis show increases in recycling and net-widening, as inferred from changes in patterns of convictions, across cohorts holding age constant. McAra's (2016) analysis may therefore be more helpful in understanding processes affecting CHS offence/court referral *between* these two institutions rather than in understanding patterns of convictions (i.e. comparing *within* courts) at different times. A potential point of similarity between these two studies is the

observation of a strong impact of previous court referral in predicting future referral (McAra 2016) and the increases in persistence observed here. Whilst the results of this analysis, then, may not describe precisely the same process of recycling as outlined in McAra (2016), both the results presented here and McAra's (2016) results may reflect what Cohen terms 'denser' nets (1985:44). It is also possible that observed differences in convictions trends between different cohorts at the same ages may reflect "continuities in institutional practices", as McAra found when comparing one cohort at different ages (2016:12), but with the *intensity* of these practices waxing and waning when comparing between cohorts.

The tension between the results presented here and those of McAra (2016) suggest the value of further investigation of temporal change in the processes that lead people to be brought into the criminal justice system. In particular, replicating McAra's (2016) analysis using a more contemporary cohort would help to tease out potential differences between cohorts in the kinds of institutional practices that McAra describes.

9.6 Conclusions

This chapter aimed to examine change in pathways of conviction over the course of the crime drop in Scotland, and so to answer the research question 'How have pathways between latent convictions groups changed over the course of the crime drop in Scotland?' This examination has highlighted a number of important points of this thesis. First, increases in prevalence for those in their mid-twenties and older as seen in Chapter Six are not just an effect of cohorts with previously high conviction rates filtering through the justice system. Instead, these increases reflect falls in the proportion of men and women making desistance transitions at the four transition points analysed and increases in both onset and persistence of conviction. Second, these increases in onset and persistence occur at a similar time (between 1998 and 2002) for men and women across most ages. This generality of effects across age at the same time implies a period effect, which in turn suggests a system effect. These results therefore indicate both a wider and denser 'net' (Cohen 1985:44) of the justice system in Scotland during this time. This idea of a general effect is further supported by the similarity in trends seen across latent classes, which show broadly similar patterns of persistence and desistance.

Original contribution

The results presented in this chapter represent, to the author's knowledge, the first analysis of pathways of conviction over the crime drop making comparisons across multiple cohorts, the strategy identified by Sampson (2015) as being key to understanding the interaction between criminal careers and the crime drop. Consequently, the dynamic of increasing persistence through the late 1990s and early 2000s is one that has not been identified by previous analysis. This finding raises an important question for criminal careers research as to whether this dynamic of increasing persistence but, from Chapters Six and Seven falling prevalence, is seen elsewhere. These results also demonstrate the value of Sampson's (2015) suggestion of making multiple comparisons across cohorts to explore change in convictions over the crime drop. These results demonstrate that convictions data, when care is taken to understand the nature of such records, provide a way to examine such change and can act as a cost-effective complement (Connelly et al. 2016) to the cohort-sequential design advocated by Sampson (2015).

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The results presented in this chapter conclude the analysis section of this thesis. Having examined all the different parameters of criminal careers, the final chapter draws these results together to reflect on what they mean for criminal careers, understanding of the crime drop and of justice policy change in Scotland.

Chapter 10. Discussion and Conclusions

10.1 Introduction

This thesis began with a problem: how similar are patterns of convictions in data from twenty years ago to criminal careers now? This problem motivated the exploration of change across multiple dimensions of criminal careers – the age-crime curve, prevalence and frequency, polarisation and pathways of conviction – in order to achieve three aims. First, this analysis sought to understand how criminal careers had changed over the course of the crime drop. Second, to use this description of changing criminal careers to reflect on the potential mechanisms leading to falling crime and conviction rates. Third, this analysis aimed to reflect upon the potential impacts of changes in Scottish justice policy based on these trends.

Having presented the results of this analysis in the previous four chapters, this final chapter draws together these results before outlining their implications for the three areas of study touched upon by this thesis. Drawing on the summary of the results, the chapter presents the main characteristics of the convictions drop in Scotland which must be accounted for by any theoretical explanation. This account is then used to present the most plausible explanation for these trends based on the theoretical accounts of the crime drop discussed in Chapter Three, and then to reflect upon areas in which these theoretical accounts of the crime drop may be refined in light of these results. Using this description, this chapter then discusses the implication of the results for understanding the impact of the justice system in Scotland in affecting conviction trends over the period analysed, and the implications of the results for current justice policy in Scotland. The substantive and methodological implications of these results for the study of criminal careers are then considered. The chapter closes by outlining the original contributions of this thesis to the study of criminal careers, the crime drop and Scottish justice policy, the limitations of the analysis and areas for further research.

10.2 Summary of results

The previous four chapters have explored patterns of convictions across four dimensions of criminal careers between 1989 and 2011. The results of this analysis have emphasised contrasting trends across age, sex and crime type and in different periods. There is a sharp contrast between falling rates of conviction for young people, particularly young men, and increases in conviction rates for those between their mid-twenties and mid-forties. These trends are driven primarily by changes in the prevalence of conviction, and result in an increasingly even distribution of convictions over age. Analysis across latent classes shows some evidence of convictions becoming less polarised for younger men and women but increasingly polarised for older men and women. Increases in conviction rates for those over 21 are explained by both greater onset of conviction and higher persistence in conviction, particularly between 1998 and 2004.

10.3 The crime drop in Scotland

The key aim of this thesis was to use descriptions of change in criminal career concepts as a way to explore the manifestation of the crime drop in Scotland. Based on the results presented in this thesis there are four characteristics of the crime drop in Scotland that any potential explanation must be able to account for:

- *Age differences*. Falling conviction rates in Scotland are driven primarily by lower prevalence of youth conviction. Because of the historic skew in convictions towards young people, declining youth convictions mask increases in convictions for older age groups. During the 1990s these contrasting trends are best understood as age-limited period effects, not cohort effects, although the descriptive approach adopted here cannot be seen as 'proof' of this assessment.
- *Sex differences*. The timing and magnitude of falling convictions across different crime types differ between men and women. Young women show relatively less of a fall in prevalence than young men, and women in their late twenties and thirties show greater relative increases in prevalence than men of the same age. Sex differences were also seen in the analysis of polarisation in Chapter Eight and in the effects of onset and persistence in Chapter Nine.
- *Period differences*. The results presented here displayed very different trends

between 1989-2000, 2000-2007 and 2007-2011. The periods of falling convictions between 1989-1999 and 2007-2011 show very different trends across age, sex and crime type. From this observation it can be inferred that either these two periods have different mechanisms driving falling conviction rates, or the same mechanism is manifest very differently in these two periods.

- *There were increases in convictions 2000-2007.* Related to the previous point, any explanation or explanations of the fall in convictions in Scotland must also be commensurate with the period of increasing convictions between 2000 and 2007.

Some elements of these findings are not specific to Scotland, and so can be considered safe to generalize to other jurisdictions. Specifically, the similarities in falls in youth crime seen in SOI seem a reasonably safe to generalize to other jurisdictions in Europe, and potentially elsewhere, given the similarities seen between these results and those in England and Wales (Morgan 2014), Sweden (von Hofer 2014, Bäckman et al 2014) and the USA (Farrell et al. 2015, Kim et al. 2015). However, the observation of increases in persistence and prevalence for those aged 25-40 may travel less well. In particular, because these effects are most consistent with period effects (as argued below), which in turn are interpreted as most likely being system effects, these results may be particular to Scotland. The lack of previous analysis of change in convictions patterns over the crime drop for the whole age distribution, as opposed to focusing on youth offending, mean there is little basis to determine how far the finding of increased conviction rates for those in their mid-twenties to forties can be generalized. Similarly, further analysis of change in criminal careers for men and women are required before the differences in trends between men and women observed in this thesis can be generalized.

Understanding the crime drop in Scotland

Based on these four observations, the most plausible explanation for the trends observed in the SOI based on the literature discussed in Chapter Three is as follows:

1989-2000

Consistent falls in convictions for dishonesty are consistent with the security hypothesis, but only for young people and particularly for young men. This effect seems to be the primary driver of overall falls in convictions during the 1990s, with demographic change also helping to reduce conviction rates. That falls in convictions are particularly concentrated in crimes of dishonesty imply a mechanism which is only operative on these crime types. Farrell et al. (2014) and Aebi and Linde (2010:271) both suggest that the most plausible explanation for falling property crimes are changes in security practices, suggesting securitization as the most plausible explanation for these trends. However, the question remains open as to why these changing security practices would not reduce conviction rates for those in their twenties and thirties. Moreover, the trend of decline only in crimes of dishonesty questions the keystone and début crime hypotheses as described as part of the wider securitization thesis by Farrell et al. (2014), as is discussed in Section 10.4 below. Therefore, whilst securitization presents the most plausible explanation for the convictions drop in Scotland during the 1990s, questions remain as to precisely how this mechanism has led to the trends observed.

In addition to this process of securitization, during the 1990s falls in crimes of dishonesty for women are offset by increases in convictions for other crime types. Whilst this analysis cannot determine the cause of these increases, they are consistent with the gendered net-widening effects described by Estrada et al. (2015) and Steffensmeier et al. (2005). There may therefore be both behavioural and system effects present during this period, but moving in opposite directions.

2000-2007

The period of increasing convictions from 2000-2007 are most plausibly attributable to a period, and so system. This effect is consistent with both net-widening and recycling driving increases in prevalence for those 25 and above, persistence and onset over the age of 21. The basis of this claim is subjective, based on the following linked observations. First, this increase in convictions is seen across age, sex and crime type. The commonality across age suggests that a cohort effect is unlikely, implying a period effect. That there was no increase in convictions for dishonesty for young people during this period suggests that securitization may have

continued to reduce convictions for dishonesty during this time, counteracting the effects of this net-widening to some extent. This would explain why there was little overall change in the prevalence of conviction for young people during this period. Second, period effects are most likely to be system effects (Soothill et al. 2004), especially if they occur at the same time as historical changes in the operation of the justice system (von Hofer 2003). Third, the period immediately after devolution led to a sharp increase in the rate of change in justice policy, with a 'punitive turn' (McAra 2016). This provides a potential mechanism for this system effect which could plausibly affect convictions of multiple crime types. Fourth, the period from 2000 to 2007 saw an increase in convictions but no equivalent increase in recorded crime and little change in police clear-up rates (see Chapter Three). Fifth, whilst the comparison is not perfect, analyses of US arrest data over the course of the crime drop (see Chapter Two) do not show this increase in arrests for those in their mid-twenties to early forties. More comparative work is required before this assertion can be accepted, but based on the currently available information (i.e. in comparison to US arrest data) it seems that this pattern of increasing conviction is particular to Scotland. Finally, there is little in the theoretical literature examining the drivers of the crime drop that would explain these increases in convictions. Any behavioural explanation would also have to counteract whatever mechanism(s) produced falling conviction rates through the 1990s and again after 2007. For example, whilst it is possible that there were increases in opportunities commit offences of every crime type except dishonesty during between 2000 and 2007, this kind of behavioural explanation seems implausible. This is not to say that such an explanation cannot exist; further investigating the causes of this increasing in prevalence for those in their mid-twenties and thirties is an important next step following the results observed here.

2007-2011

The final period of falling convictions from 2007-2011 is best explained by a more general effect than the first period of crime drop between 1989 and 2000. That this second period of falling convictions relates to changes in behaviour wider than just the effect of securitization reducing crimes of dishonesty is based on two observations. First, falls in convictions are seen across crime types and for both young men and women. Second, falling conviction rates during this period come at

the same time as falls in the prevalence of other 'risky' behaviours amongst young people, such as alcohol and drug use (NHS National Service Scotland, 2014). Whether lower levels of alcohol and drug consumption are *causing* falls in crime, or whether falls in crime and other 'risky' behaviours are the products of a common cause is not possible to discern from this analysis. However, these trends indicate that understanding recent shifts in the culture and activities of young people are an important endeavour for criminologists[143]. It seems implausible that trends in this period could be driven by the début and keystone crime hypotheses as described by Farrell et al. (2014) given that the first period of crime drop does not fit with these explanations.

It is also possible that falls in convictions since 2007 may reflect a system effect combining with behavioural changes to reduce convictions in this later period. The shift towards diversion in Scottish justice policy since 2007 (see discussion in Chapter Three), may be interacting with lower levels of offending behaviour leading to both a behavioural and system effect in producing lower conviction rates. As the results presented in Chapter Six were not definitive as to whether these trends represented cohort or period effects it is not possible to ascertain whether lower conviction rates are due to offending or system behaviour. The international nature and concurrent timing of falls in youth crime as discussed in Chapter Two (for example Morgan 2014:22) suggest Scotland-specific effects of change in justice policy may be unlikely to explain falling youth convictions entirely. This is an area which would benefit from further research, both drawing on comparisons with other jurisdictions.

10.4 Implications for theories of the crime drop

Given the inductive nature of our understanding of the crime drop (Baumer 2010), criminologists looking to understand recent falls in crime can benefit from the kind of close empirical reading of convictions trends as presented here. The results described here provide several helpful points by which existing theories of the crime drop can be refined. The following section outlines the implications of these results of the securitization, multifactor, cultural and demographic explanations of the

143 It is worth noting that these social changes leading to reduced convictions may not be entirely positive for those involved (Nugent and Schinkel 2016).

crime drop respectively. This section then discusses the implications of these results for how theories of the crime drop are constructed.

Securitization, keystone crimes and début crimes

The findings of this thesis have a number of implications for the security hypothesis. First, the falling in convictions for dishonesty which drive overall declines in convictions through the 1990s are commensurate with the emphasis of the security hypothesis on reductions in acquisitive crime (Farrell et al. 2014). The assertion of Farrell et al. (2015) that the crime drop is primarily reflected in falling prevalence of adolescent crime is also borne out in these results[144]. The fall in crimes of dishonesty for Low and High as well as the Dishonesty classes seen for young men, and the subsequent inference of a general effect, is in line with an environmental mechanism such as more effective security measures. Such a mechanism would presumably affect both low and high rate offenders equally. However, Chapter Eight demonstrated that trends in membership of the Dishonesty and High latent classes differed between men and women, suggesting potential differences across sex in the patterns of convictions summarized by the latent class models. These findings may also suggest different effects in the role of increased securitization for men and women; this may be an area that future research into securitization may investigate.

However, as mentioned in Section 10.3 much of the analysis presented here runs counter to the expectation of the securitization thesis relating to increased desistance due to securitization and the keystone and début crime hypotheses. The security hypothesis predicts greater desistance[145] as a function of reduced opportunities to offend. In contrast, Chapter Nine showed declining desistance for men and women across all age groups and classes of offender. Whilst there are limits of convictions data are limited in their capacity to describe desistance from offending (see McAra and McVie 2007, 2010), by the measures used in this analysis there seems little support for the idea that desistance has increased over the course of the crime drop.

144 This observation though seems to be based more on Moffitt's (1993) description of criminal careers than stemming directly from the assumed effects of changing security measures (see Farrell et al. 2015:4)..

145 Or as Farrell et al. (2015:4) put it, "when crime opportunities are plentiful there is more continuance than when they are scarce".

The keystone hypothesis contends that reductions in crimes of dishonesty are themselves likely to lead to fewer offences of other crime types. As measured by aggregate convictions data in this study, this effect is not seen for the crime drop in the 1990s. Whilst the general falls across crime type seen in the second period of crime drop are more in line with the keystone crime hypothesis, it is unclear why this mechanism would affect convictions trends after 2007 but not before this. These results fit both with Tonry's (2014) critique that the proposed link between falling crimes of dishonesty and other crime types is not plausible, and also with Aebi and Linde's (2010) suggestion that the mechanism driving acquisitive crime rates differs to that influencing other types of crime. It is important to recognize that this study has not sought to be a direct test of the keystone crimes hypothesis[146]. It is important to note the role of the keystone crime hypothesis in securitization theory; this hypothesis explains how reductions in dishonesty can lead to falls in other types of crime *to explain aggregate falls in these other crime types over the course of the crime drop*. Such effects should, therefore, be of sufficient magnitude to be observed in this kind of aggregate-level study, otherwise they would seem poor candidates to be able to explain aggregate declines in crime.

The results presented here also provide little support for the début crime hypothesis. Once again, this thesis has not sought to test this hypothesis directly, and it should again be noted that convictions data are perhaps not the best data source with which to investigate this hypothesis. However, a key contention of the début crime hypothesis is that increases in crime for those of older ages (in Farrell et al.'s [2015] study, arrests for those in their mid-forties) are attributable to a *cohort* effect, flowing from a legacy of "plentiful crime opportunities in the 1970s and 80s" (Farrell et al. 2015:4). This explanation does not fit with the observation that increasing convictions for those over the age of 25 are most plausibly seen as a *period* effect, not a cohort effect, and similarly that falling convictions for dishonesty though the 1990s are best seen as an age-limited period effect. This questions the capacity for the début crimes hypothesis to explain these trends.

In total, the security hypothesis provides a valuable contribution to understanding the crime drop by providing a plausible explanation for falls in crimes of dishonesty.

146 Indeed, it may be questioned to what extent convictions data can ever test this hypothesis, given the gap between offence and prosecution and the principal offence rule (see Chapter Four).

However, given the exploratory focus of this analysis this explanation should be considered *plausible* rather than *proven*; there may be other factors that have led to declines in crimes of dishonesty outwith the security hypothesis. Moreover, contentions about the mechanisms through which crimes of dishonesty relate to other types of crimes based on the keystone and début crimes hypotheses, as well as the assumed effect of increasing desistance were not supported by the results presented here. There are also questions as to why effects of securitization would be manifest differentially for men and women of different ages. Further work to understand differences across age in the effect of securitization may be a fruitful avenue for further research.

Multifactor explanation

Perhaps in part because of the relatively large number of components involved in this account of the crime drop, Aebi and Linde's (2010) multifactor explanation fits better with the results observed here than a purely securitization explanation. In particular, the differing trends seen in conviction rates for different types of crime between 1989 and 2000 suggest that multiple factors are required to understand these trends, as suggest by Aebi and Linde. Moreover, the implied focus of the multifactor explanation on the prevalence of offending (see Chapter Three) rather than the frequency of offending is in line with the analysis presented here. This may also relate to the focus of this study on Scotland, and Aebi and Linde's development of the multifactor explanation on data drawing on Western Europe (2010, 2012).

The most important implication of these results for the multifactor explanation are the different periods of trends observed in the SOI data. That the different components of the multifactor explanation can have different effects at different times is in line with the multifactor explanation but not explicitly framed as part of Aebi and Linde's (2010) thesis. Understanding why different factors were particularly operative in different periods may allow the multifactor explanation to provide a better account of the trends observed here (see also Humphreys, Francis and McVie 2014). There are three areas in which these temporal differences are most important. First, the falls in convictions across crime types for young men and women after 2007 may be best explained by what Farrell et al. (2014), term as a 'consolidation' effect, further reducing crime rates following a period of

securitization. This notion fits better with the different trends seen over time than the static account provided by Aebi and Linde. Second, it may be that factors which Aebi and Linde (2010) propose as leading to increases in violent crimes, such as drug and alcohol consumption, are now leading to lower rates of conviction. Drug and alcohol use for young people in Scotland have declined since the mid-2000s (NHS National Service Scotland, 2014) rather than increasing as was suggested by Aebi and Linde (2010) at the time of their formulation of the multifactor explanation[147]. Finally, the discussion of particular cohorts involved with both acquisitive crime and drug use as described by Morgan (2014) provides an example of this specificity. The cohort effect for drugs offences observed in Chapter Six and the increase in membership of the Dishonesty class – which also had a high rate of convictions for drugs offences - for those above the age of 25 seen in Chapter Eight, lends support to the presence of the type of cohort effect described by Morgan (2014) explanation. Whilst this interpretation is not definitive, as the results of the LCA described in Chapter Eight are not a direct measurement of a potential drug-user cohort, such effects the potential for cohort effects as described by Morgan (2014) show the value of considering temporal differences in the effects of the different factors described by Aebi and Linde.

That the cohort described by Morgan (2014) are between their late twenties and forties highlights that understanding trends for older adults, rather than just young people, presents another area where the multifactor explanation could be refined. In particular, some of the mechanisms described by Aebi and Linde (2010) seems poor candidates to explain changes in convictions rates for those in their twenties and forties. For example, gang activity does not seem to be a plausible explanation for increases in convictions for people from their mid-twenties to forties, as this is typically a youth activity (McVie 2010:21).

Cultural change

As discussed in Chapter Three, theories of cultural change are more difficult to relate to change trends across different career parameters because the impact of cultural change on offending can be difficult to express quantitatively (Rosenfeld 2000,

147 It is also possible that factors such as alcohol and drug consumption were products of an underlying cause, such as cultural change amongst young people (see below) rather than were independent causal factors reducing crime as presented by Aebi and Linde (2010:271).

Wilson 2012). In addition, the sweep of Tonry's (2014) account is intentionally very broad and is focused on very long-term terms. As such, Tonry's description of cultural change does not seem a good candidate to explain the marked periods seen in the SOI data, which span only a couple of decades, and in particular the increase in conviction rates from 2000 to 2007. As a result, this broad theory of cultural change also would seem unsuitable to describe the decline in youth convictions after 2007, despite the general nature of this fall across crime type aligning with Tonry's (2014:54) prediction of falls in violence crime in Europe.

As well as the distinct periods observed, the differences across age in conviction trends show an important area where cultural theories of the crime drop can be refined. The results presented in this thesis suggest that the focus of cultural explanations for falling crime rates should be on changes in youth culture, as suggested by Young (2004) and Barker (2010), rather than the broad 'cultural change' as advocated by Tonry (2014) and Eisner (2014). For example, Eisner's (2014) discussion of the declining importance for hedonistic preferences may benefit from a focus on how and why this change would particularly affect young people but not those in their twenties and forties. Again, describing these changes with the APC framework may help provide more specificity. However, for those who focus on subcultural theories and "urban youth culture" (Young 2004:34), the finding of increasing conviction rates for those in their twenties and thirties suggest the need for a wider criminological focus beyond adolescence (Sampson and Laub 1993, Cullen 2011). Cultural explanations of the crime drop crime must be clear as to *whose* culture has changed and how, and how these effects would be anticipated to manifest over age and within different periods.

For those who focus specifically changes in youth sub-culture (Young 2004), the similarities in falling youth crime as seen here and as shown in other studies based in other countries (Chapter Two) suggest the importance of a cross-national aspect to further research into how changes in youth culture have impacted on the crime drop. A particular focus of such analysis could be to analyse the effects of wider internet access on youth culture. This could help to provide further detail to Aebi and Linde's (2010) contention that increasing internet use among young people has led to falling crime rates through changes in the "exposure to the risk of engaging in

conventional delinquency" (2010:273). The interface between changing youth culture and time spent online is one to which sociologists have dedicated considerable time (for example Turkle 2011), but little analysis has been conducted as to how internet use has changed youth culture as it relates to offending[148]. Investigating such links from a criminological perspective may help to provide a more in-depth account as to how internet usage has affected the prevalence of offending amongst young people.

Demographic change

As discussed in Chapter Seven, demographic change did contribute to falling convictions in Scotland during the 1990s, but has had very little contribution to the second period of crime drop from 2007. This is in line with previous analysis which (Zimring 2007, Levitt 1999) showed a limited role of demographic change in explaining falling crime rates, and in particular the inability of demographic changes to explain sharp changes in conviction rates. Whilst demographic changes seem to have acted alongside other factors in reducing crime rates, they are not *the* explanation for falls in crime.

Theorizing the crime drop

Aside from the impacts on each of the theories of the crime drop discussed above, the results of this analysis also have implications for how these theories are refined. For those who seek a single explanation for the crime drop, one way to use these observations to inform understandings of the crime drop is to reconcile them with Farrell's (2013:2) five tests for a theory of the crime drop. The "variable trajectories" test, which suggests a hypothesis must be commensurate with cross-national change and change across crime type, can be amended to also account for changes across sex and age. To account for changes across different periods, the "prior crime increase test" can be amended allow for different periods of contrasting trends in crime since the start of the crime drop in the early 1990s.

However, it may also be that the discrepancies across periods suggest that the crime drop is likely to be the result of multiple factors interacting in different ways in

148 For example, David Wall was "currently", as of 2015, researching the impact of time spent online as a "civilising" influence on young people (Wall 2015), rather than just representing a decline of time spent on the street.

different times. This interpretation is in line with the analysis of Humphreys, Francis and McVie (2014) who found that different covariates had different relationships with recorded crime in Scotland at different periods of the crime drop. This would suggest that the framework of looking for *a* theory of the crime drop (Farrell 2013) which can be reconciled with divergent trends at different times may lead to conclusions that are too broad, when what is required is an understanding of the particular factors affecting falling crime rates in different periods. Further empirical analysis such as that of Humphreys, Francis and McVie (2014) could help to distinguish potentially different effects of factors such as those outlined by Aebi and Linde (2010) on both conviction rates and crime rates more broadly.

10.5 Justice policy in Scotland

A third aim of this thesis was to understand change in criminal careers with reference to policy change in Scotland between 1989 and 2011. As well as informing the understanding of change in criminal careers, comparing trends in convictions patterns with change in justice policy helps to reflect on the potential impacts of changing justice policy in Scotland. The analysis presented in this thesis has two primary implications for understanding the development of justice policy in Scotland. First, it seems unlikely that the actions of the justice system have directly caused falls in conviction. Second, the period effects identified here between 2000 and 2007 are in line with, but do not prove, an interpretation of the "punitive turn" (McAra 2016) as leading to both net-widening and recycling of people through the justice system, suggesting wider effects of this policy era than previously described.

Prevalence and the impact of formal sanctioning mechanisms on offending

On balance, the results of this analysis suggest that policing and imprisonment practices have not played an important role in reducing conviction rates in Scotland by reducing offending. This conclusion is primarily based on the assertion of Blumstein et al. (1988a) and Berg et al. (2016, citing MacLeod et al. 2012), falls in prevalence and not frequency imply that the mechanism leading to falling crime rates is a general one, and not one targeted at high rate offenders. Results presented in Chapters Seven and Eight both suggest that prevalence has played a lesser role in reducing convictions than has frequency. It should be noted that a smaller impact of

frequency of conviction as opposed to prevalence in SOI will be to some extent influenced by convictions data underestimating the frequency of offending (Aebi and Linde 2012). Indeed, Berg et al.'s (2016) analysis of changing prevalence and frequency showed a greater effect of falling frequency of conviction than that presented here. However, the results of Chapters Nine also support the conclusion that falling convictions are due to the numbers of people convicted in the first instance prevalence, given the higher proportion of people who persist, and also escalate in conviction noted in Chapter Nine. Together, these results suggests that 'tertiary mechanisms' of crime prevention, such as those through courts and policing are unlikely to have a played a role in reducing the volume of convictions in Scotland. Given that this analysis is not a direct assessment of the impact of policing strategies or imprisonment rates, this can only be considered tentative support for the idea that these factors have not influenced the crime drop in Scotland. However, this observation is in agreement with the wider literature (Tonry, 2014; Farrell et al. 2014) which suggest that changes in national justice policies and trends in imprisonment are unlikely to have played a role in reducing crime rates internationally, due to the country-specific quality of such factors and the international nature of the crime drop. Together, these factors suggest policing and imprisonment are unlikely to have played a significant role in reducing conviction rates in Scotland.

System effects: net-widening and recycling during the 'punitive turn'

If the conclusion of a period effect as suggested in Section 10.3 is accepted, it suggests that the effects of the era of increasingly punitive justice policy in Scotland between 2000 and 2007 may have been wider than previously discussed. The results of Chapter Nine suggest that the "punitive turn" (McAra 2016:5) during the early 2000s increased the persistence of men and women of all ages across different conviction classes identified by LCA. This increase in persistence, combined with the increase in onset transitions seen in Chapter Nine, suggest that between the late-1990s and the mid-2000s the justice system in Scotland retained a higher proportion of people convicted as well as drawing in a higher rate of people over the age of 21. Previous work which had discussed the potential impacts of recycling (McAra and McVie 2010a) and net-widening (Piacentini and Walters 2006) during this period has primarily focused on young people. The results presented in Chapter

Nine illustrate that these effects may have a much wider scope than just young people. Moreover, Chapter Seven shows that in the period 2000-2007 effect of increases in prevalence for those in their mid-twenties and thirties were counteracted by there being comparatively fewer people of this ages in the population. If it were not for this demographic change the net-widening and recycling effects would have been even more pronounced. It is worth restating that these system effects are inferred by comparing trends between policy eras in Scotland; that is, that net-widening and recycling effects are described *relative* to convictions trends from the previous policy era. Replication of this analysis in England and Wales, which also saw a focus on punitive youth justice policies and anti-social behaviour but which began prior to these policy changes being implemented in Scotland (Croall 2006), may provide insight into the effects of this policy agenda in absolute terms. If England and Wales did not also see increases in conviction rates between 2000 and 2007 this may be a further indication that the net-widening and recycling effects observed in this thesis are attributable to punitive turn in Scotland.

As noted in Section 10.3, despite the similarity in timings of the fall in convictions after 2007 and the start of the 'compassionate' era in Scottish justice, the results presented in this analysis are ambiguous as to whether this change in justice policy has influenced this decline in conviction rates. Consequently, the results of this thesis may be a better indication of a system effect due to the 'punitive turn' (McAra 2016) rather than support for the new policy programme implemented after 2007 in reducing youth offending[149].

Policy implications

The results of this thesis have four main implications for current justice policy in Scotland. First, the results of this thesis emphasise the importance of keeping young people out of court in the first instance. This emphasis on diversion is in line with the policy program adopted by the SNP government administration after 2007. The importance of diversion is shown by the prominent role of prevalence in reducing conviction rates combined with the observation of increased persistence between

149 The results of Matthews (2016) suggest falls in youth convictions after 2008 do not reflect diversion into non-court disposals, and so a system effect of 'different nets' seems implausible.

2000 and 2007. These two observations suggest that falling conviction rates are driven by fewer people receiving a first conviction, not by higher rates of desistance after receiving a conviction. Given the potential for justice system contact itself to lead to more future convictions (McAra and McVie 2010a), diversion should continue to inform justice policy in Scotland to keep people out of the justice system. Even though the results of this thesis do not provide proof of an effect of diversionary policies implemented after 2007 in directly reducing offending rates, at the very least this change in the direction of justice policy may represent addition by subtraction in moving away from the net-widening effects of the 'punitive turn' as discussed above.

Second, the results of this analysis have described change in the mix of people convicted in Scotland which have implications for how the justice system handles those who are convicted. That the prevalence of conviction for those in their twenties and thirties did not decrease between 2007-2011, even while prevalence did decline for younger people, suggests that such demographic groups should increasingly be the focus of efforts to help reduce reoffending. Moreover, as the mix of people convicted shifts away from men and women in their late teens, the justice system response to reoffending must take account of potentially different needs (associated with age) for those who are convicted. Accounting for such potential differences is in line with the findings of the Scottish Government's recent review of 'what works' to reduce reoffending, which emphasised that interventions to reduce reoffending should not operate on a one-size-fits-all basis (Sapouna et al. 2015). Moreover, these demographic shifts may place different strains on services available. The plans to move women from Scotland's women's prison (HMP Cornton Vale, see Scottish Government, 2016c) to Scotland's young offender institution (HMYOI Polmont) – facilitated by lower levels of youth offending freeing up places in Polmont – provides an example of this kind of adaptation.

Third, the finding that increases in onset and persistence between 2000-2007 are best explained by a period effect implies that such effects may be both time-limited and amenable to policy change. Indeed, the increases in the number of men and women under the age of 25 making desistance transitions after 2004 is a positive sign that such effects are not immutable. This finding emphasises that justice policy

and the actions of the justice system matter well into adulthood, even if the results of this study have focused on a period effect which decreased desistance. This should be seen as encouragement that policy can make a difference to convictions trends beyond just early-years development programmes as advocated by, for example, Gottfredson and Hirschi (1990).

Finally, the substantial change in the age distribution of the convicted population identified in this thesis also has implications for the way reconviction rates are measured in Scotland. The National Indicator for reconviction is the "average number of reconvictions per offender" (Scottish Government 2016a)[150]. As a population average measure, this figure not only captures changes in age-specific reconviction rates, but is also sensitive to changes in the demographic composition of the convicted population as a whole[151]. Demographic changes in the mix of people convicted can affect the population average reconviction rates because young men and women typically have higher reconviction rates than older men and women (Scottish Government 2016). Reductions in the proportion of young men and women in the population of those convicted can therefore reduce the *average* conviction rate even if there is no change in the conviction rate for each age group. One way to quantify this bias is using the standardization and decomposition techniques as employed in Chapter Seven, and further work in this area is encouraged. The danger of ignoring this potential bias is that groups whose convictions trends do not follow the declining trend – such as women in their thirties – may be overlooked if the sole focus is on the aggregate National Indicator[152].

10.6 Implications for Criminal Careers Research

The results of this analysis have implications for the study of criminal careers more broadly than just in relation to the recent drop in crime, both substantively and in relation to research designs and methods adopted for analysis.

150 See http://www.gov.scot/About/Performance/scotPerforms/indicator/reconviction (Accessed July 31 2016)

151 This is because of Simpson's paradox (Simpson **1950**)

152 The Scottish Government (2016b) does publish reconviction figures for men and women of different ages. Arguably these figures should be the primary focus of the Scottish Government, rather than the National Indicator.

Substantive implications

The most important substantive finding of this thesis for criminal careers research are the distinct periods of change across the four dimensions of criminal careers analysed. These periods provide an illustration of Sampson's (2015) contention that incorporating macro-social change into frameworks of criminal careers research is important to understanding how offending develops over people's lives. This cautions against grand, universal statements about the manifestation of relationship between age and crime in convictions data. As a consequence, the invariance thesis of Gottfredson and Hirschi (Hirschi and Gottfredson 1983) – that the relationship between age and crime should be substantively considered the same in all times and places – may be helpful as a heuristic device, but does not accurately the age-crime curve as measured in convictions data. Analysing change over time in the relationship between age and crime is not "revel[ing] in … statistical noise" (Gottfredson and Hirschi 1988:49), but is necessary descriptive work to ensure that understandings of criminal careers keep pace with changes in social context, such as the recent crime drop. Similarly, analysis of polarisation showed that a smaller group of people, as measured by membership of the High latent class, consistently contributed a disproportionately large volume of all convictions. This is in line with a classic finding of criminal careers research (Wolfgang et al. 1972), but the demographic composition of this group identified here has shifted to be less dominated by young men.

A particular element of macro-social change emphasises by the results presented in this thesis is change in institutional context. The logical consequence of the observation of a period effect in transition between convictions classes in Chapter Nine is that there are factors entirely out of the control of people convicted in courts which affect the likelihood of them receiving a conviction (see also McAra 2016). It is already known that the relationship between conviction and offending in the development of criminal careers is complex (see McAra and McVie 2010a), with potential long-term, negative effects of justice system contact (McAra and McVie 2007, Lopes et al. 2012). The observation of period effects in this analysis stresses the importance of criminal careers research to understanding such effects (Sampson and Laub 2016).

Whilst the finding of sex differences in conviction patterns is not new to criminal careers research, the differences in convictions trends for men and women observed in this thesis are important for the study of recent change in criminal careers. These findings suggest that generalizing from male-only studies, such as Berg et al. (2016) may misrepresent change in women's criminal careers over the course of the crime drop. The results presented here also add nuance to the findings of those who have emphasised that declines in offending over the crime drop have been disproportionately experienced by men (Lauritsen et al. 2009; Von Hofer, 2014 and Bäckman et al., 2014). The discrepancy in convictions patterns between older and younger men and women suggests that to analyse changes in the gender gap without accounting for age, and vice versa, can give only a partial picture of change in aggregate crime rates. To paraphrase Lauritsen, Heimer and Lynch (2009:391), whatever social forces have reduced offending over the crime drop, they have not benefited women and men or young and old equally. Both sex and age differences must be accounted for when examining change in patterns of criminal careers.

Implications for research design

The observation of a period effect influencing patterns of convictions has implications for how research into criminal careers is conducted. Sampson (2015) champions the study of multiple cohorts as a way of examining change over time and the results of this thesis emphasise the value of examine change across multiple cohorts. When comparing results across multiple cohorts in self-report studies, as in Berg et al. (2016) this is likely to require focusing on a narrow age-range or potentially on male-only samples. The variation in trends across age and sex seen in the analysis presented here highlight the limitations of such an approach, and demonstrate the benefits of the coverage provided by administrative data, which are a cost-effective way of exploring change over multiple cohorts Francis et al. (2004a). Whilst not without challenges (see Connelly et al. 2016), administrative data, and SOI in particular, provides an important resource that can be used to conduct these multiple cohort comparisons efficiently. This provides a way to avoid the criticism of raised during the criminal careers debate of the 1980s that longitudinal research is prohibitively expensive (Gottfredson and Hirschi 1987). Furthermore, the flexibility provided by administrative data such as SOI allows for the combination of cross-sectional and cohort examinations of age and crime, suggesting that the distinction

between cross-sectional and longitudinal research itself becomes less relevant to the use of administrative data.

Given these benefits of using administrative data to analyse criminal careers, further research using SOI is encouraged. The periods identified in the analysis also have implications for any such future use of SOI. Analysis using SOI should be informed by descriptive analysis of the relevant trends in the dataset, and an awareness of the divergence of trends across age, sex and in different time periods. The generalizability of results based on SOI to future criminal careers must be accounted for during analysis. This may entail restricting the range of data analysed (for example, focusing on convictions from 2007 onwards to include only the most recent period of falling conviction rates) or by testing whether results were robust using data drawn from different years.

Implications for methods used

The analysis presented in this thesis has used two novel statistical methods which could benefit further research into criminal careers: shaded contour plots and the generalized specification of standardization and decomposition analysis. Both of these techniques provide advantages to other approaches commonly employed in the criminological literature, and their adoption in future analyses is encouraged. Shaded contour plots (Minton et al. 2013, Vaupel et al. 1987) provide a straightforward way for annual change in the age-crime curve to be visually represented. When sufficient data are available, such plots provide substantial advantages over other visualisation techniques in being able to accommodate very large volumes of data into a single image, and so to provide a way to visually analyse age, period and cohort effects. The use of shaded contour plots is encouraged as a method of exploratory data analysis to examine change in the age-crime curve in other datasets, and such analysis would provide a helpful way to contextualize the results presented in this study.

The analysis presented in Chapter Seven has two main implications for the use of standardization and decomposition techniques to understand temporal change in the relationship between age and crime. First, when used to described change over time, standardization and decomposition should be accompanied by descriptive

analysis of trends in the variables used. As the results presented here illustrate, using this technique without an appreciation of potentially different effects in different periods can present misleading results. Second, the contrasting trends between prevalence and frequency identified in Chapter Seven illustrate the value of assessing the impact of prevalence and frequency on conviction rates separately during standardization and decomposition. This can be done easily using the generalized formulae presented by Das Gupta (1993) and adopted here. This specification of standardization and decomposition also has advantages in being robust to the selection of reference year, and should be adopted by subsequent decomposition analyses in criminology as opposed to the 'direct' approach used by Levitt (1999) and Rosevear (2010).

10.7 Original contributions

Taking the results of this analysis together, this thesis has made original contributions to each of the three areas outlined in its introduction: criminal careers, the crime drop and development of Scottish justice policy. These contributions can be summarized in five main themes.

First, this thesis has contributed to the understanding of how criminal careers have changed over the course of the crime drop by analysing patterns of criminal careers in a previously unexplored case. This has helped to affirm the understanding of the crime drop as a youth crime drop, but also to question the extent to which declines in arrest rates for people in their mid-twenties and thirties as seen in the USA (Farrell et al. 2015, Kim et al. 2015) can generalized to other jurisdictions. Given the necessity understanding the crime drop drawing on multiple cases (Farrell 2013) this analysis is an important contribution and suggests the value of further investigation of patterns of criminal careers in other jurisdictions.

Second, this analysis presents the first examination of change in criminal career parameters over the course of the crime drop for men and women of different ages. The four research questions analysed each provide an original insight to their respective criminal careers parameters, which are discussed at the end of Chapters Six through Nine. The finding throughout this thesis of contrasting trends in convictions across sex and age highlight the important of these distinctions to future

studies of how criminal careers have changed over the course of the crime drop, suggesting that macro-social factors influencing criminal careers (Sampson 2015) may affect men and women differently. This also adds nuance to the literature regarding the declining gender gap in offending, suggesting that such an analysis must also account for diverging trends across age as well as sex.

Third, the focus on annual change across parameters of criminal careers is an important contribution of this thesis to the criminal careers literature, and particularly the examination of the age-crime curve. Examining annual variation identified periods with distinct patterns of convictions which would have been obscured by the typical research design of comparing age distributions across widely-spaced time points, and cuts against the assumption that long time periods are required to identify meaningful change in the age-crime curve (Ulmer and Steffensmeier 2014). As a result, further examination of annual change in the age-crime curve over the course of the crime drop is encouraged.

Fourth, the results of this thesis provide important additional information for those attempting to explain the crime drop both in Scotland and further afield. In particular, the contrasting trends identified across age, sex and in different periods suggest the need for a more nuanced account of the crime drop than those provided by the security hypothesis and the multifactor explanation as these accounts are currently specified. This thesis has also demonstrated that examining change in criminal careers provides a valuable framework which can be used to generate results that can be used to refine theories of the crime drop.

Finally, the work presented here has provided a new perspective on the impacts of justice policy change in Scotland between 1989 and 2011. By empirically examining trends in convictions data and comparing these trends with narratives of policy change this analysis has identified patterns that are most convincingly explained as the impact of changes in justice policy interacting with underlying trends in offending. The descriptive nature of this analysis does not prove that such patterns were caused by justice policy change, but this thesis illustrates that empirical analysis using the age-period-cohort framework (Kim et al. 2015) provides a valuable analytical tool with which to assess the impact of policy change. The results

of the analysis suggest that the eras in Scottish justice as defined by McAra (2016) do indeed show distinctive patterns of convictions across age, sex and crime type. This inference is in agreement with concerns regarding policy change leading to net-widening and recycling during this period (Piacentini and Walters 2006, McAra and McVie 2010a).

10.8 Limitations and areas for further research

As with any study, there are a number of limitations of this research which must be acknowledged. Some of these limitations suggest areas for further investigation.

First, in focusing only on sex and age this study has not considered other potentially important factors related to the shape of the age-crime curve, such as socio-economic status. This is has been shown to be an important factor in understanding the declining gender gap in offending (Estrada et al., 2015). Such data are not currently available in Scotland and so were not able to be included in this analysis. This is an important area in which future research could expand upon the findings of this analysis should such data become accessible.

Second, due to the nature of the data held in the SOI it not been possible to examine changes in offending for those under the age of 16. This limits the capacity of our findings to understand changes in the period typically associated with mass onset of offending during early adolescence (Moffitt, 1993). As Farrell et al. (2015) discuss, changes in onset of offending are a potentially important factor to understanding changes in criminal careers over the course of the crime drop. This is another area which future research may benefit in exploring.

Third, it should be noted that the descriptive approach adopted here – whilst not a limitation as such – does constrain the inferences that can be drawn from this analysis. As previously mentioned, replication of this analysis in another jurisdiction is strongly encouraged in order to better understand whether effects identified, particularly relating to increases in prevalence and persistence in the early 2000s, are specific to Scotland. A systematic comparison of timings of falls in youth convictions in different jurisdictions would help to understand whether these trends were due to Scotland-specific factors or part of a more general cross-national trend.

Finally, whilst this analysis has a number of important implications for theories of the crime drop, further investigation of change in criminal careers could help to provide greater insight into these mechanisms. In particular, the potential impact of the début crime hypothesis, whilst not supported by the results presented here, could be analysed at the individual level using SOI. This could be achieved by, for example, using the type of crime for which a person was first convicted as a predictor of latent class membership and transition probability between latent classes. Whilst outside the scope of this thesis, such analysis would provide a more direct insight into whether this hypothesised link between type of first conviction and subsequent patterns of criminal careers is plausible at the individual level. It is possible that such effects may be observed at the individual level even though the results presented has not identified effects commensurate with this hypothesis at the aggregate level.

10.8 Summing Up

This thesis set out to explore trends in Scottish convictions data over the course of the crime drop across different parameters of criminal careers. In doing so this thesis has shown important change in the age-crime curve, prevalence and frequency, polarisation and pathways of conviction. More broadly, this analysis has demonstrated that examining trends across different criminal career parameters is a valuable way to both understand the recent crime drop and is necessary to link patterns of criminal careers to broader social changes. Simply put, to understand the crime drop requires an understanding of changing patterns of criminal careers, and at the same time criminal careers research must relate understandings of how offending develops over people's lives to changes in social context such as the crime drop. Furthermore, by informing this analysis with contextual knowledge about changes in Scottish justice policy, this thesis has provided new insight into the potential impacts of policy change in Scotland upon patterns of convictions. These three components of criminal careers, the crime drop and Scottish justice policy have been analysed together throughout this thesis, and the results demonstrate that an understanding of the relationships between these component is necessary to understand the patterns observed in the SOI.

This brings us back to the question posed at the start of this thesis; how similar are

patterns of convictions in data from twenty years ago to criminal careers now? The analysis presented here has shown both important changes in criminal careers, but also that these changes defies simple description. The answer to the question 'how similar?' depends on whether one is interested in overall conviction rates or the mix of crime types, or men or women, or young or old. Above all, this thesis has demonstrated the value of taking a close, empirical reading of patterns of criminal careers to explore change in aggregate convictions trends. Everything flows.

Appendices

List of Appendices

Appendix 1. Time points examined by studies of change in the age-crime curve.....293
Appendix 2. Visual representation of cohorts covered by SOI.....294
Appendix 3. List of offences covered in SOI.....295
Appendix 4. Scottish Government Counting Rules.....296
Appendix 5. Trends in offence codes in SOI.....298
Appendix 6. Standardization and decomposition results (population figures).....299
Appendix 7. Formulae for Different Information Criteria.....303
Appendix 8. Mean and variance of different types of crime when divided into five-year age-bands, SOI.....304
Appendix 9. Comparison of LCA results across Time in Prison caps.....305
Appendix 10. Change in descriptive statistics over time.....307
Appendix 11. Unstandardised contour plots for different crime types.....308
Appendix 12. Contour plots for shoplifting, theft not elsewhere classified (excluding from motor vehicles) and all other crimes of dishonesty.....310
Appendix 13. Frequency of convictions for women convicted of Prostitution and other crimes classified in All Other Crimes and Offences.....311
Appendix 14. Classification uncertainty, classification probabilities and class membership.....312
Appendix 15. Change in membership of latent classes for men and women of different ages.....316
Appendix 16. Comparison of proportion of people classified into latent classes and proportion of convictions for different crime types served to latent classes.....317
Appendix 17. Transitions between latent classes using most likely class assignment..319
Appendix 18. Trends in transitions between latent classes.....320
Appendix 19. List of abbreviations.....326
Appendix 20. List of figures and tables.....327
Appendix 21. Unsmoothed contour plots.....330

Appendix 1. Time points examined by studies of change in the age-crime curve

Table A1.1 Studies investigating change in the age-crime curve and time points analysed

Study	Case	Time points
Britt III (1992)	USA	1952-1987, five-year increments
Farrell et al. (2015)	USA	Initial years of 1980 and final year of 2010. Middle year varied by crime type between 1988 and 1994.
Farrington (1986)	England and Wales	1950, 1960, 1970 and 1980, 1938, 1961 and 1983 for men and women separately
Greenberg (1985)	USA	1970, 1975, 1980
Hiraiwa-Hasegawa (2005)	Japan	1995-2000, five year increments
Kim et al. (2015)	New York State, USA	1990-2010 five-year increments
Steffensmeier et al. (1989)	USA	1940, 1960 and 1980
Ulmer and Steffensmeier (2014)	USA	1940, 1980 and 2010

Appendix 2. Visual representation of cohorts covered by SOI

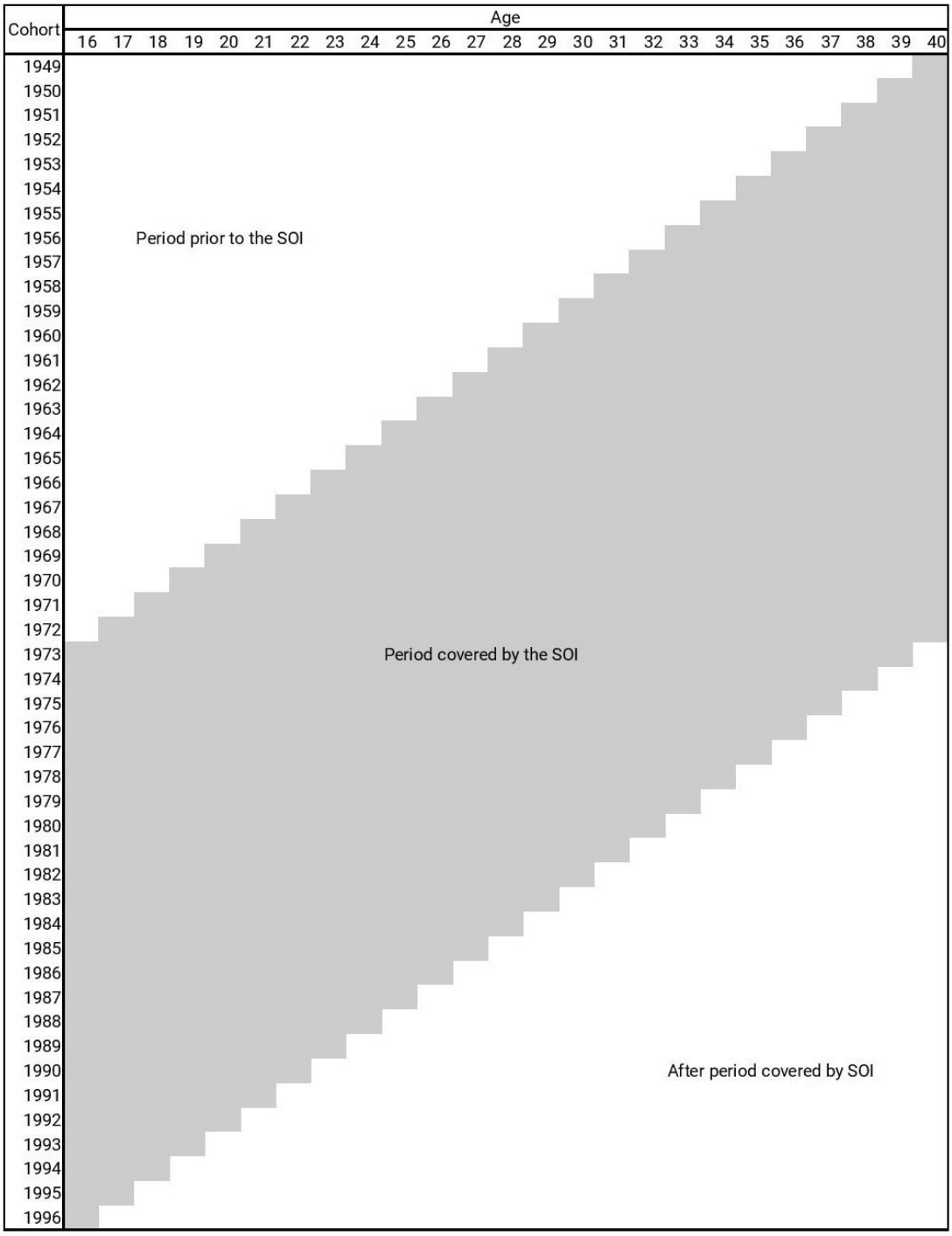

Figure A2.1 Visual representation of period covered by SOI.

Appendix 3. List of offences covered in SOI

Table A3.1 Offences included in SOI

Crime category in this thesis	Crime category as used by Scottish Government	Crimes and offences included
Violent crime		Murder, culpable homicide, attempted murder, serious assault, robbery, common assault, death involving a motor vehicle, other violence.
Dishonesty		Housebreaking, theft by opening lockfast places, theft of motor vehicle, other theft, fraud, other crimes of dishonesty and social security offences
Criminal Damage		Fire-raising, vandalism
Drug offences		Illegal importation, supply or possession of drugs, other drug offences.
Breach of the peace		Breach of the peace, racially aggravated harassment, racially aggravated conduct, threatening or abusive behaviour, offence of stalking, offensive behaviour at football, and threatening communications (under the Offensive Behaviour at Football and Threatening Communication Scotland Act 2012).
Other crimes and offences		Crimes against public justice, (breach of sexual offender order and breach of sexual harm order are included in crimes against public justice), handling offensive weapons (in possession of an offensive weapon; having in a public place an article with a blade or point, and restriction of weapons), miscellaneous firearm offences, other crimes and offences (not elsewhere specified).
Other crimes and offences	Sexual crime	Rape; attempted rape; contact sexual assault (13-15 yr. old or adult 16+); sexually coercive conduct (13-15 yr. old or adult 16+); sexual offences against children under 13 years; and lewd and libidinous practices. Other sexually coercive conduct; other sexual offences involving 13-15 year old children; taking, distribution, possession etc. of indecent photos of children; incest; unnatural crimes; public indecency; sexual exposure; and other sexual offences.
	Prostitution	Procuration (excluding homosexual acts); brothel keeping; immoral traffic; offences related to prostitution; procuration of homosexual acts; procuration of sexual services from children under 18; and soliciting services of a person engaged in prostitution.

Source: Scottish Government (2016:59). In this study the categories of Sexual crime and Prostitution are included under the category of All other crimes and offences.

Appendix 4. Scottish Government Counting Rules

"A2 Generally only the initial court sentence is included in the statistics on convictions, so that, for example, a person fined is regarded as fined, even if he or she subsequently goes to prison in default of payment. Similarly, the offenders released from prison who are included in the analysis in this bulletin will only include those directly sentenced to prison, i.e. persons released after imprisonment for fine default are excluded. Also, no account is taken of the outcome of appeals, or of interim decisions such as deferral of sentence.

…

A3 If more than one set of court proceedings against an offender is disposed of on the same day, then each proceeding will be counted as a separate conviction record in the SOI database.

A4 Where a person is convicted for more than one charge, then it is the main crime/offence which is recorded in the SOI. The main crime/offence is taken to be the charge receiving the severest penalty. If more than one charge receives the same (or a combined) penalty, then the main crime/offence is the one judged to be the most serious based on the Scottish Government's classification of crimes and offences. The exception to this is where an offender was sentenced for a crime against public justice (such as failure to appear) and other crimes/offences on the same day, then the most serious of the latter is taken as being the main crime/offence (even where the crime against public justice had attracted the heaviest penalty).

…

A6 Information on the actual release dates of prisoners is not linked with the conviction data held on the SOI. For the purposes of the analysis in this bulletin, the date of release for offenders given a custodial sentence has therefore been estimated from their date of sentence, the length of sentence imposed, assumptions about time spent on remand and release on parole, and information about whether the offender

had been granted bail. The release date estimated by this approach will not always tie in with the actual release date because, for example the offender may be serving other custodial sentences. ”

(Scottish Government 2016:56-58)

Appendix 5. Trends in offence codes in SOI

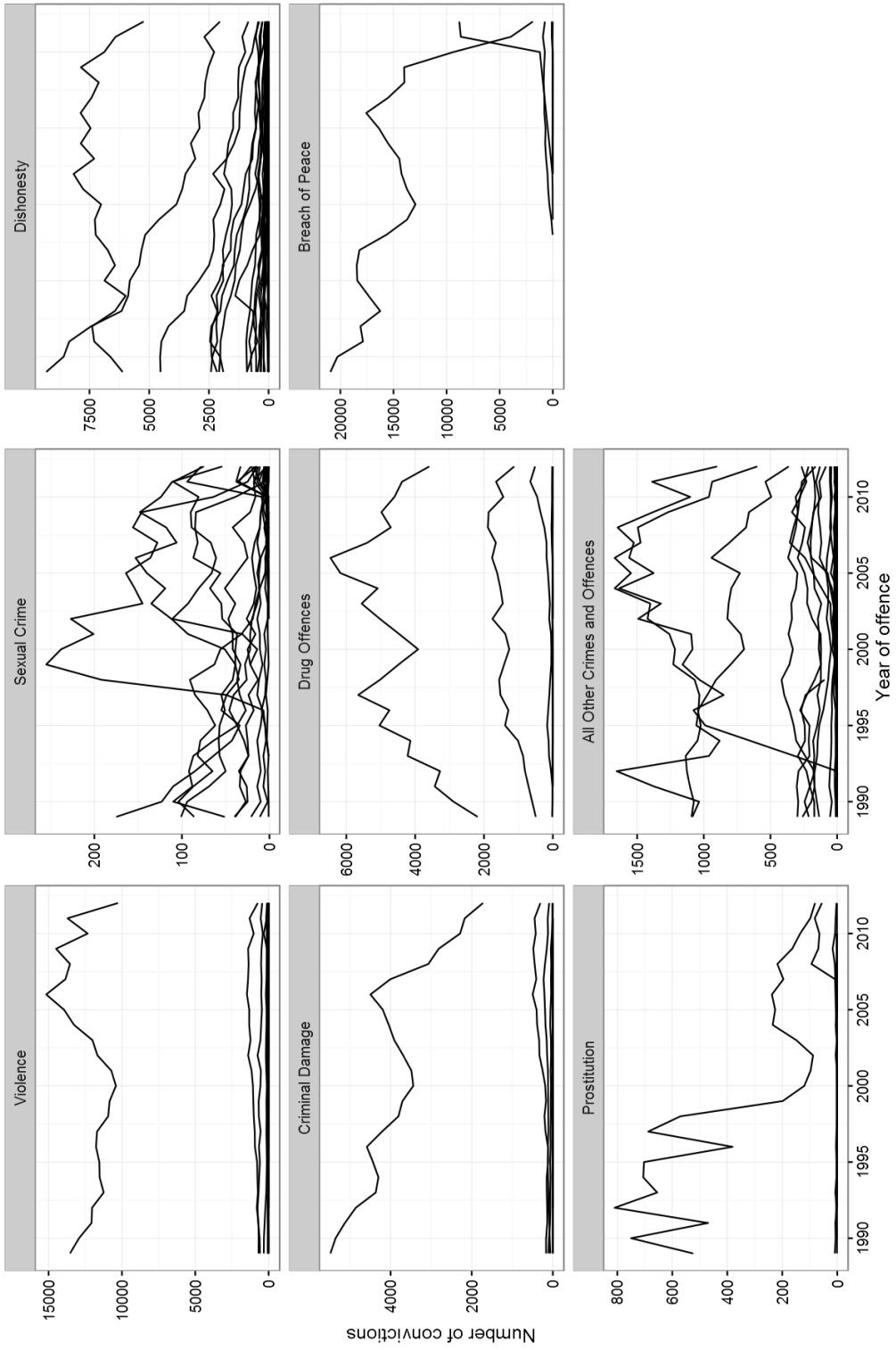

Figure A5.1. Trends in convictions of different crime types in SOI by crime group, 1989-2011.
Note: Each line represents a different type of crime within crime groups. Due to the large number of crime types, individual crime types are not labelled.

Appendix 6. Standardization and decomposition results (population figures)

Table A6.1. Standardization and Decomposition of convicted offending counts by age, prevalence and frequency, men 1989-2011.

Convicted offending count	Standardization		Decomposition		
	1989	2011	Difference (Effects)		% distribution of effects
Prevalence-frequency (βγ) standardized count	61,886.89	56,693.49	Age (α)	-5,193.40	21.94
Age-frequency (αγ) standardized count	66,791.95	51,357.62	Prevalence (β)	-15,434.33	65.21
Age-prevalence (αβ) standardized count	60,777.72	57,737.45	Frequency (γ)	--3,040.27	12.85
Unadjusted convicted offending count	72,351	48,683			
Difference in crude count	-23,668		Total	-23,668	100

Source: Conviction data from SOI, population data from National Records of Scotland (2014). Figures to 2dp.

Table A6.2. Standardization and Decomposition of convicted offending count by age, prevalence and frequency, women 1989-2011.

Convicted offending count	Standardization		Decomposition		
	1989	2011	Difference (Effects)		% distribution of effects
Prevalence-frequency (βγ) standardized count	9,775.11	9,234.09	Age (α)	-541.02	63.72
Age-frequency (αγ) standardized count	9,573.48	9,421.69	Prevalence (β)	-151.79	17.88
Age-prevalence (αβ) standardized count	9,586.79	9,430.60	Frequency (γ)	-156.19	18.40
Unadjusted convicted offending count	9,987	9,138			
Difference in crude count	-849		Total	-849	100

Source: Conviction data from SOI, population data from National Records of Scotland (2014). Figures to 2dp.

Table A6.3. Standardization and Decomposition of convicted offending count by age, prevalence and frequency, men 1989-2000, 2000-2007, 2007-2011.

Convicted offending count	Standardization		Decomposition		
	Year		Difference (Effects)		% distribution of effects
Period One					
	1989	2000			
Prevalence-frequency (βγ) standardized count	65,143.64	55,745.26	Age (α)	-9,398.39	41.49
Age-frequency (αγ) standardized count	66,813.83	54,016.74	Prevalence (β)	-12,797.08	56.49
Age-prevalence (αβ) standardized count	60,823.49	60,364.96	Frequency (γ)	-458.53	2.02
Unadjusted convicted offending count	72,351	49,697			
Difference in crude count	*-22,654*		*Total*	*-22,654*	*100*
Period Two					
	2000	2007			
Prevalence-frequency (βγ) standardized count	52,287.76	53,195.70	Age (α)	907.93	15.36
Age-frequency (αγ) standardized count	49,349.27	56,096.25	Prevalence (β)	6,746.98	114.14
Age-prevalence (αβ) standardized count	53,589.83	51,845.92	Frequency (γ)	-1,743.91	-29.50
Unadjusted convicted offending count	49,697	55,608			
Difference in crude count	*5911*		*Total*	*5911*	*100*
Period Three					
	2007	2011			
Prevalence-frequency (βγ) standardized count	51,550.80	52,794.24	Age (α)	1243.44	-17.96
Age-frequency (αγ) standardized count	56,128.11	48,152.54	Prevalence (β)	-7975.57	115.17
Age-prevalence (αβ) standardized count	52,215.67	52,022.79	Frequency (γ)	-192.87	2.79
Unadjusted convicted offending count	55,608	48,683			
Difference in crude count	*--6925*		*Total*	*-6925*	*100*

Source: Conviction data from SOI, population data from National Records of Scotland (2014). Figures to 2dp.

Table A6.4. Standardization and Decomposition of convicted offending count by age, prevalence and frequency, women 1989-2000, 2000-2007, 2007-2011.

Convicted offending count	Standardization		Decomposition		
	Year		Difference (Effects)		% distribution of effects
Period One					
	1989	2000			
Prevalence-frequency (βγ) standardized count	9,876.26	8,899.83	Age (α)	-976.43	78.24
Age-frequency (αγ) standardized count	9,440.08	9,328.86	Prevalence (β)	-111.22	8.91
Age-prevalence (αβ) standardized count	9,459.13	9,298.78	Frequency (γ)	-160.35	12.85
Unadjusted convicted offending count	9,987	8,739			
Difference in crude count	*-1248*		*Total*	*-1248*	*100*
Period Two					
	2000	2007			
Prevalence-frequency (βγ) standardized count	9,739.11	9,792.49	Age (α)	53.38	2.61
Age-frequency (αγ) standardized count	8,717.87	10,802.33	Prevalence (β)	2,084.46	101.88
Age-prevalence (αβ) standardized count	9,804.75	9,712.90	Frequency (γ)	-91.85	-4.49
Unadjusted convicted offending count	8,739	10,785			
Difference in crude count	*2,046*		*Total*	*2,046*	*100*
Period Three					
	2007	2011			
Prevalence-frequency (βγ) standardized count	9,888.86	10,051.83	Age (α)	162.97	-9.89
Age-frequency (αγ) standardized count	10,959.65	8,977.87	Prevalence (β)	-1,981.78	120.33
Age-prevalence (αβ) standardized count	9,880.26	10,052.07	Frequency (γ)	171.81	-10.43
Unadjusted convicted offending count	10,785	9,138			
Difference in crude count	*-1,647*		*Total*	*-1,647*	*100*

Source: Conviction data from SOI, population data from National Records of Scotland (2014). Figures to 2dp.

Table A6.4. Comparison of Standardization and Decomposition of convicted offending rates and convicted offending counts.					
Sex	Comparison	Factor	Population	Age structure	Difference
Men	1989-2011	Age (α)	21.94	36.15	-14.21
		Prevalence (β)	65.21	53.3	11.91
		Frequency (γ)	12.85	10.55	2.3
	1989-2000	Age (α)	41.49	42.02	-0.53
		Prevalence (β)	56.49	55.97	0.52
		Frequency (γ)	2.02	2.01	0.01
	2000-2007	Age (α)	15.36	-49.98	65.34
		Prevalence (β)	114.14	202.15	-88.01
		Frequency (γ)	-29.5	-52.18	22.68
	2007-2011	Age (α)	-17.96	8.07	-26.03
		Prevalence (β)	115.17	89.75	25.42
		Frequency (γ)	2.79	2.18	0.61
Women	1989-2011	Age (α)	63.72	78.93	-15.21
		Prevalence (β)	17.88	10.46	7.42
		Frequency (γ)	18.4	10.61	7.79
	1989-2000	Age (α)	78.24	79.27	-1.03
		Prevalence (β)	8.91	8.48	0.43
		Frequency (γ)	12.85	12.24	0.61
	2000-2007	Age (α)	2.61	-15.46	18.07
		Prevalence (β)	101.88	120.78	-18.9
		Frequency (γ)	-4.49	-5.32	0.83
	2007-2011	Age (α)	-9.89	5.35	-15.24
		Prevalence (β)	120.33	103.64	16.69
		Frequency (γ)	-10.43	-8.99	-1.44
Source: Conviction data from SOI, population data from National Records of Scotland (2014). Figures to 2dp. Positive numbers show that a factor is more important to the decomposition when measured with population figures rather than age structure.					

Appendix 7. Formulae for Different Information Criteria

For AIC the penalty applied is based on the number of free parameters as determined by

$$AIC = -2\ logL + 2\ p$$

Where *logL* is the log-likelihood of the solution being tested and *p* is the number of free parameters in the model under consideration (Akaike, 1987). AIC does not contain a penalty for sample size. In contrast BIC incorporates a term to account for sample size, defined as

$$BIC = -2\ logL + p\ ln(n)$$

Here, as with AIC, *logL* is the log-likelihood of the solution being tested and *p* is the number of free parameters whilst *n* is the sample size (Schwartz, 1978). The aim of this term is to prevent the selection of an unnecessarily complex model when the sample size is large (Dziak et al. 2012). This formula is also the basis of Sclove's (1987) adjusted BIC which uses the formula

$$ABIC = -2\ logL + p\ ln((n+2)/24)$$

This adjustment makes the penalty for model complexity less severe than that of BIC (Dziak et al. 2012).

Appendix 8. Mean and variance of different types of crime when divided into five-year age-bands, SOI

Table A8.1. Mean and variance of convictions five-year age-bands, multiple crime types

	Crime Type					
Measure	Violence	Dishonesty	Criminal Damage	Drugs	Beach of Peace	All other crimes and offences
Mean	0.47	0.75	0.16	0.23	0.51	0.18
Variance	0.60	3.54	0.20	0.30	0.92	0.31

Source: SOI.

Appendix 9. Comparison of LCA results across Time in Prison caps

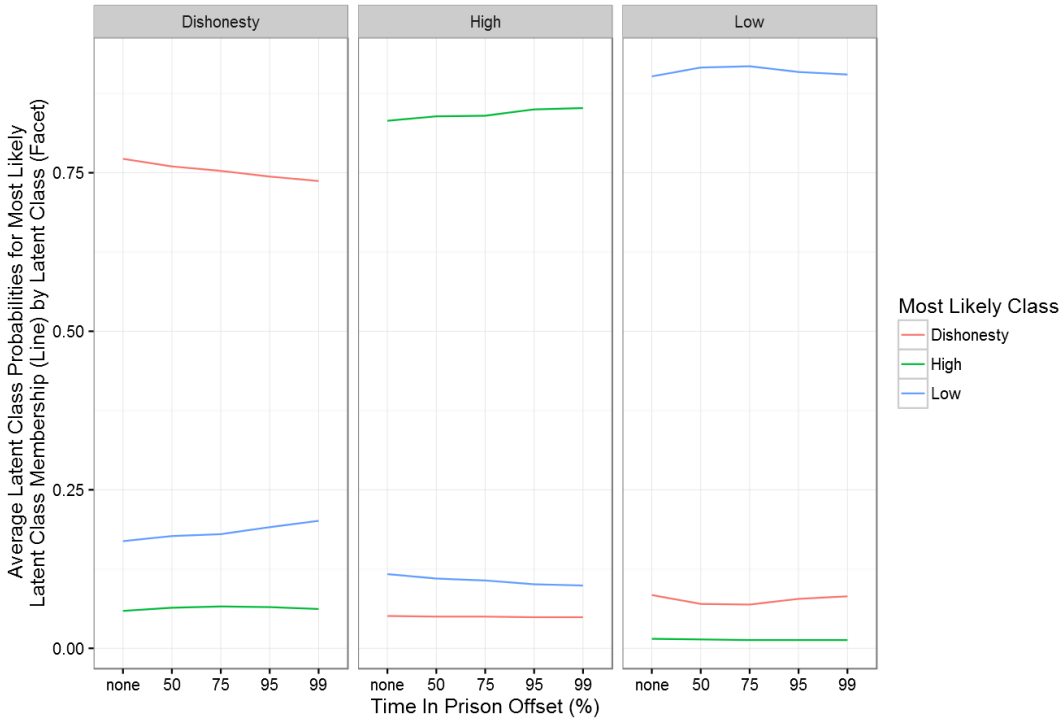

Figure A9.1 Change in average latent class probabilities across time in prison caps

Table A9.1 Change in class proportions across time in prison caps					
	Cap				
Class	None	50	75	95	99
Low	0.82	0.84	0.84	0.83	0.83
Dishonesty	0.12	0.10	0.10	0.11	0.11
High	0.06	0.06	0.06	0.06	0.06
Entropy	*0.719*	*0.746*	*0.751*	*0.736*	*0.729*
Source: SOI					

Changing the time in prison cap also had little substantive impact on trends in polarisation. As an example, Figure A9.2 overleaf replicates Figure 8.4, but trends represent membership of classes estimated without a time in prison cap. The results are incredibly similar. The average difference in the proportion of people classified between solutions is -0.0022 for the Dishonesty class, 0.0013 for the High class and 0.00091 for the Low class.

Figure A9.2. Proportion of men and women of different ages assigned to latent classes (estimated without a time in prison cap)
Note: This figure is a reproduction of Figure 8.4, but using a latent class solution estimated without a time in prison cap

Appendix 10. Change in descriptive statistics over time

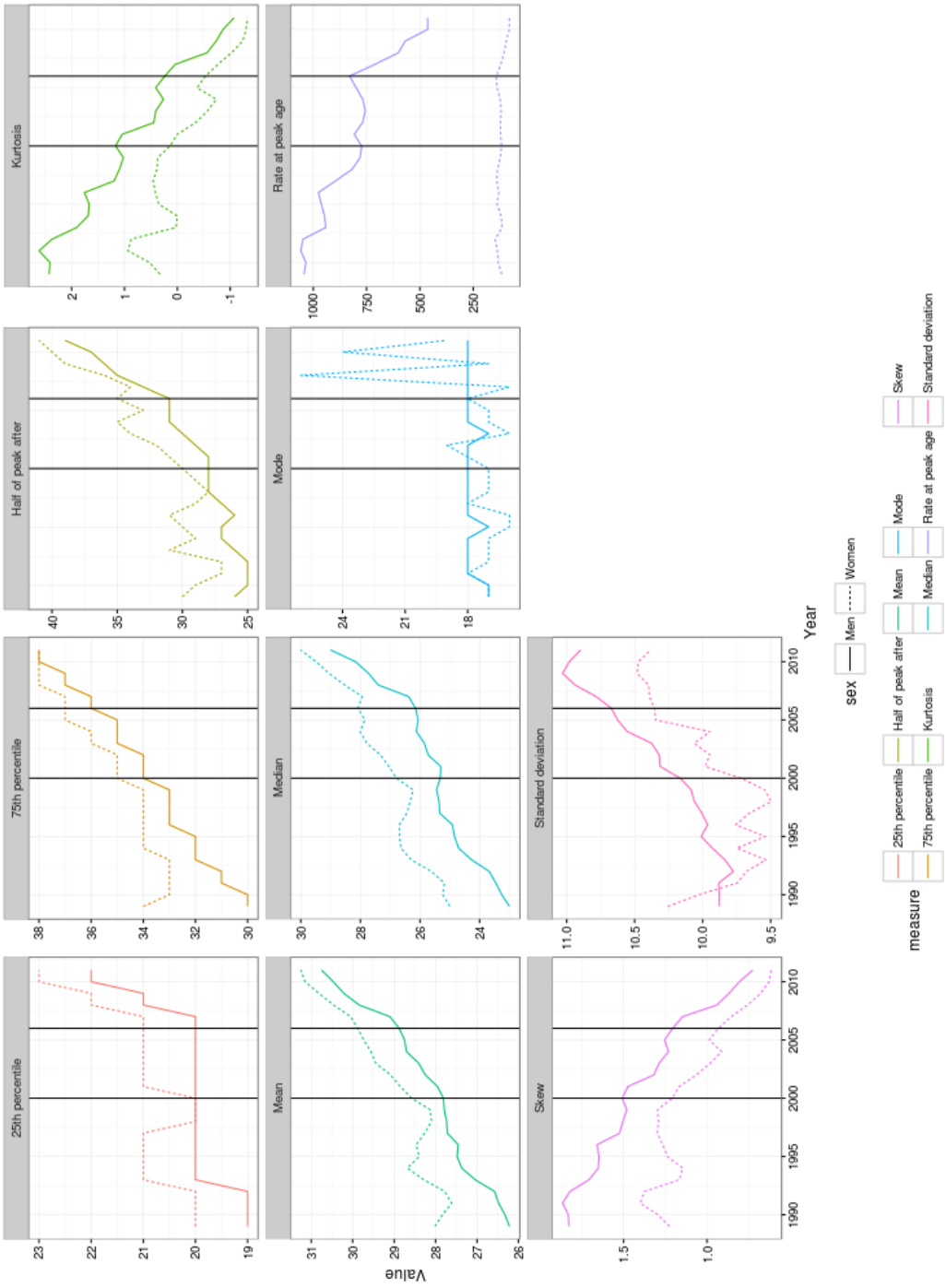

Figure A10.1. Descriptive statistics for all convictions in SOI 1989-2011

Appendix 11. Unstandardised contour plots for different crime types

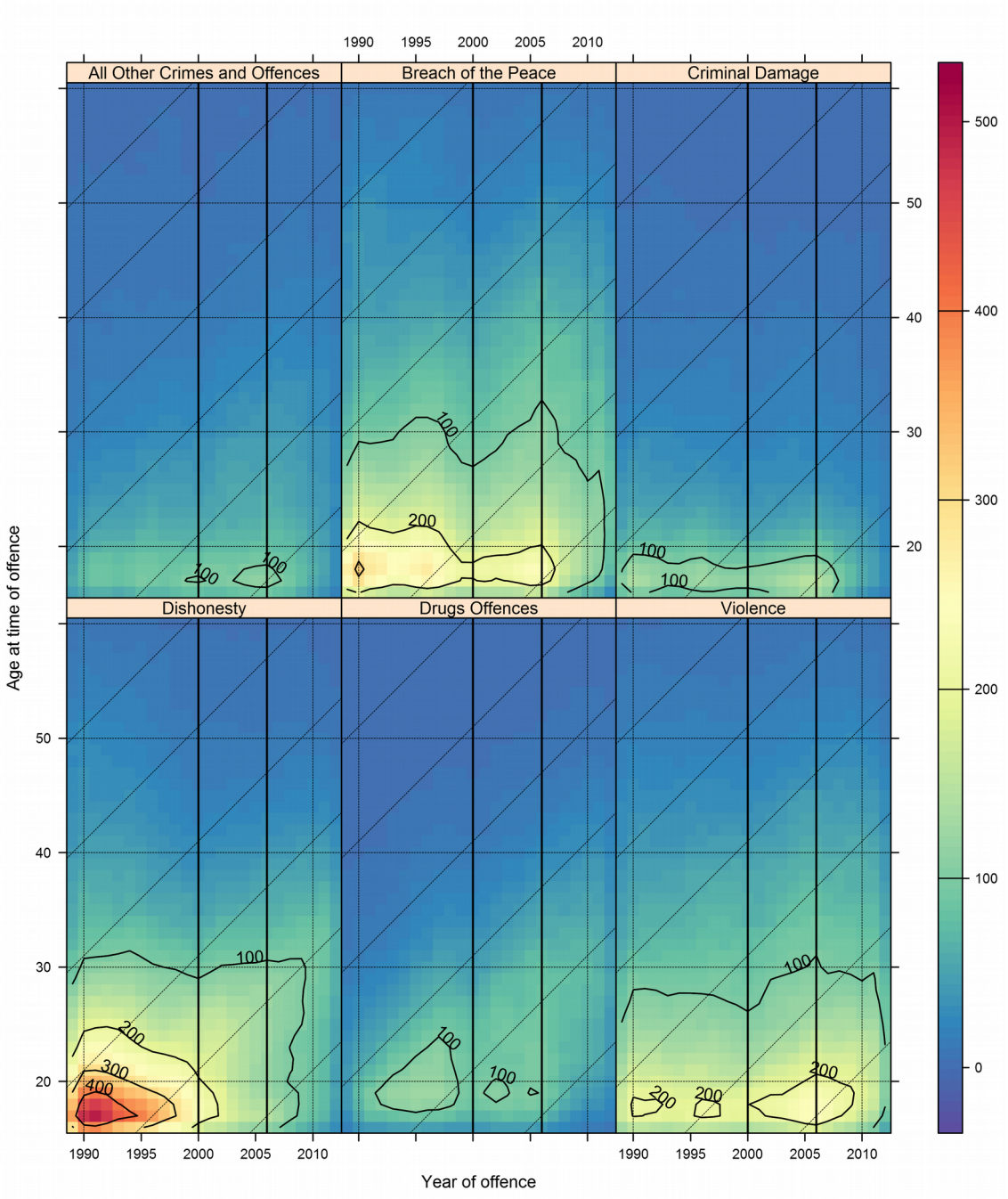

Figure A11.1. Shaded Contour Plot of prevalence of convicted offences for different crime types in SOI 1989-2011, men

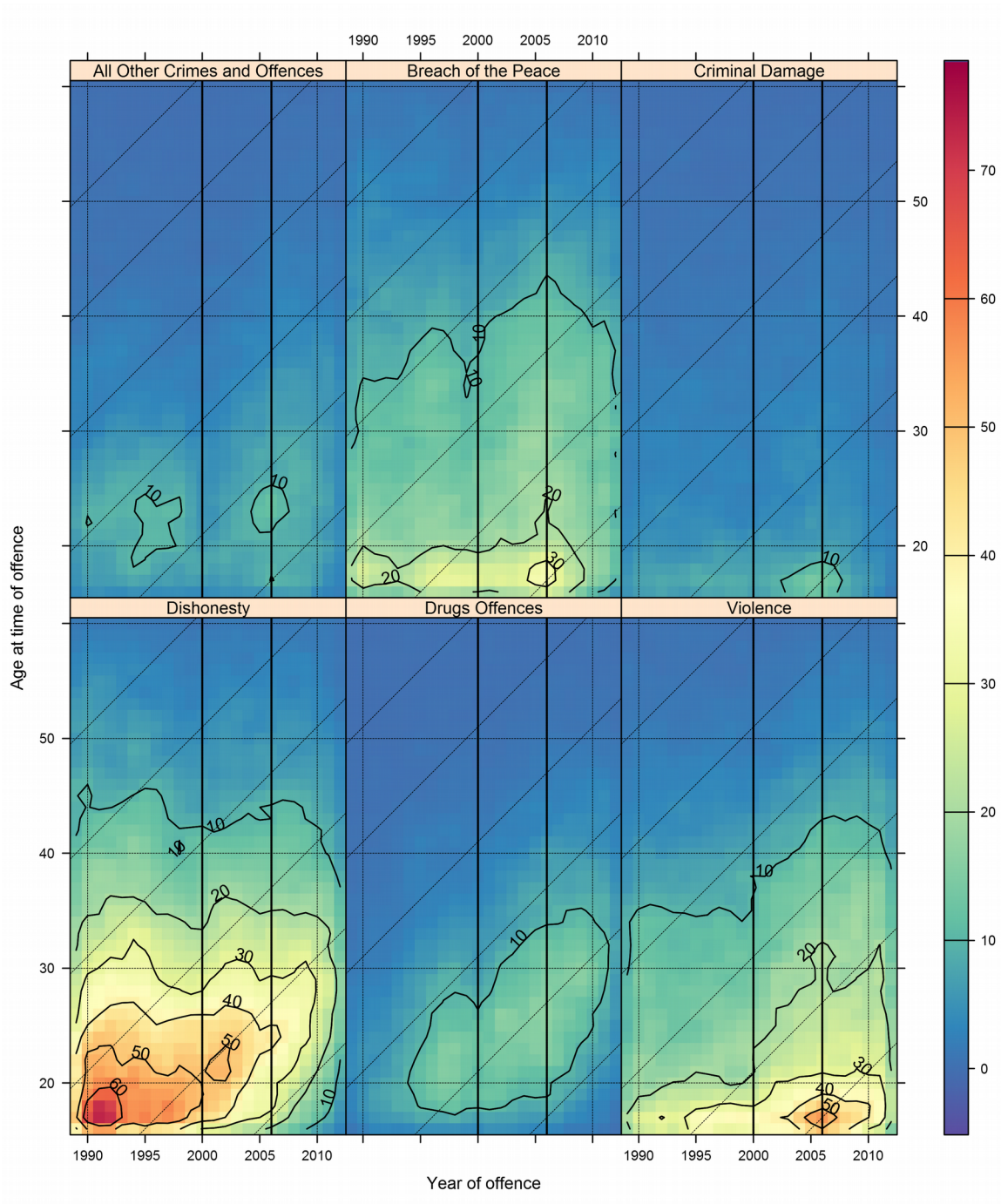

Figure A11.2. Shaded Contour Plot of prevalence of convicted offences for different crime types in SOI 1989-2011, women

Appendix 12. Contour plots for shoplifting, theft not elsewhere classified (excluding from motor vehicles) and all other crimes of dishonesty

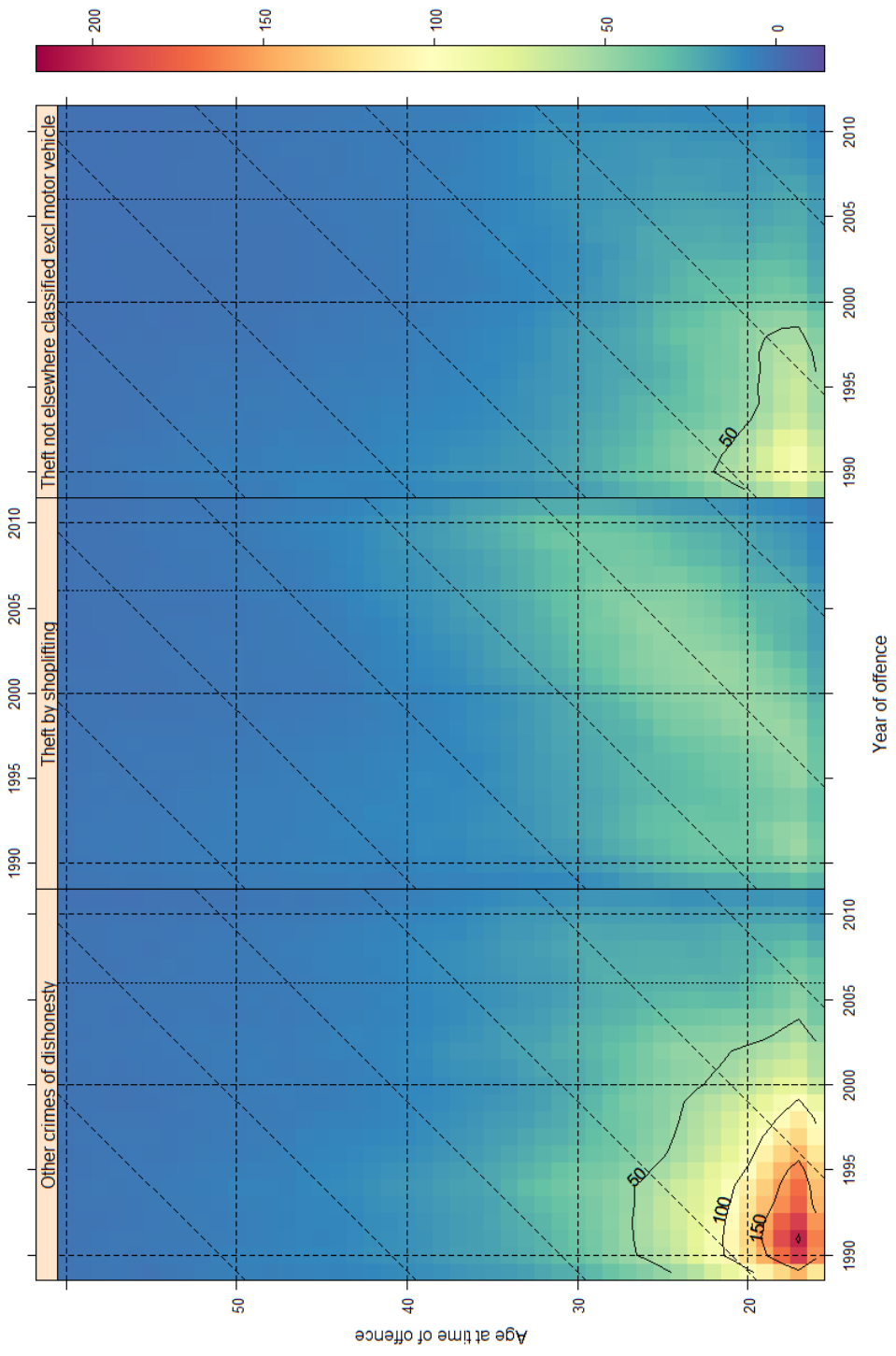

Figure A12.1. Contour plots for selected crimes of dishonesty in SOI 1989-2011

Appendix 13. Frequency of convictions for women convicted of Prostitution and other crimes classified in All Other Crimes and Offences

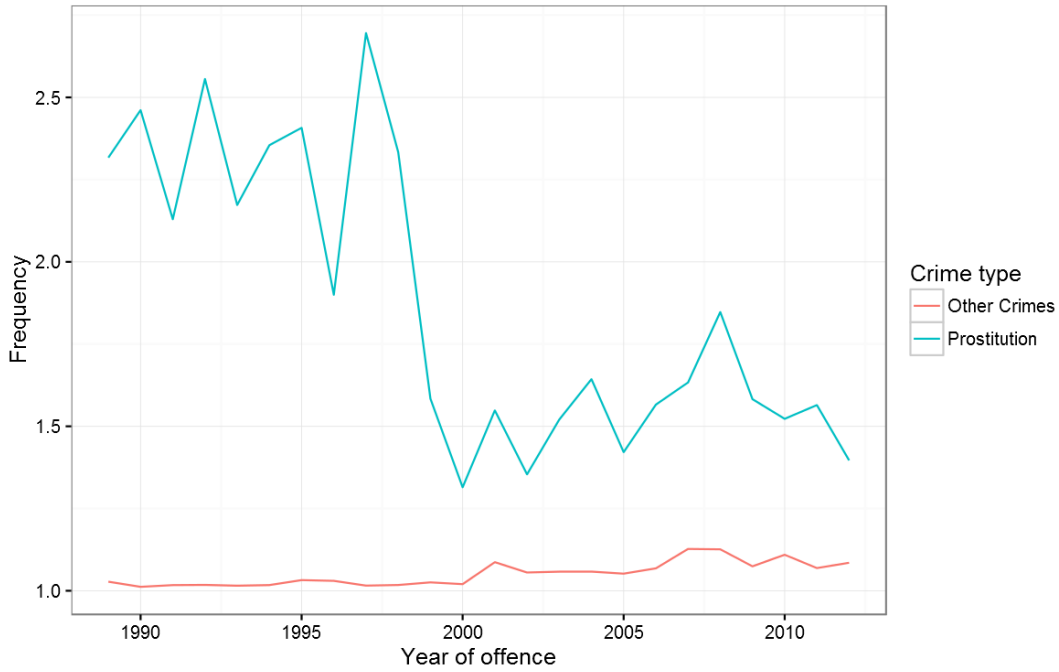

Figure A13.1. Comparison of frequency of conviction for prostitution and other crimes classified in all other crimes and offences (women) SOI 1989-2011

Appendix 14. Classification uncertainty, classification probabilities and class membership

Table A14.1 Class proportions for LCA estimated on all age bands (posterior probabilities)

	k			
Class Description	2	3	4	5
Low	0.922	0.823	0.624	0.581
High	0.078	0.059	0.035	0.037
Dishonesty	-	0.119	0.048	0.047
Low-Dishonesty	-	-	0.293	0.330
Very High Versatile	-	-	-	0.005
Entropy	*0.869*	*0.721*	*0.620*	*0.668*

Source: SOI

Table A14.1 presents the size of the different classes produced by different LCA solutions for the SOI data as a whole. The bottom row also shows the entropy, a measure of classification quality. Together these figures provide an indication of how the LCA is dividing up the convictions data in SOI between different *k* solutions. In the two class solution the group of high-rate offenders is very small – just less than 8%. This group becomes even smaller in the three class solution as members of this group and members of the low group are combined into the dishonesty class. The fourth class fractures the low-rate and dishonesty classes to produce a large (around 30% of the SOI) group of low-rate dishonesty offenders, with the size of the High class also decreasing. The final class added by the *k*=5 solution (Very High group) is very small, comprising less than half of one percent of the SOI.

Looking at classification uncertainty, entropy declines with an increasing number of classes to *k*=4, before increasing again for the *k*=5 solution. As values of entropy closer to one indicate a more distinct separation of classes, this shows that the *k*=2 model provides the clearest distinction between groups. For the *k*=4 class in particular, the distinction between groups is not clear. Examining the average latent class probabilities for each class provide a way to examine which classes are leading to this low entropy (Table A16.2). H3gh values on the diagonal of the table (e.g. Low latent class, Low most-likely class) indicate a clear distinction between solutions. In the *k*=4 solution, those classified into the Low-Dishonesty class as their most-likely class have a probability of 0.319 of belonging to the Low class, the highest off-diagonal probability. The next highest off-diagonal values are 0.165 and 0.110 for, respectively, members of the Low

Table A14.2 Average latent class probabilities by most-likely class, *k*=4 solution				
	Latent class			
Most-likely class	Low	Dishonesty	High	Low-Dishonesty
Low	0.818	0.008	0.008	0.165
Dishonesty	0.022	0.774	0.094	0.110
High	0.081	0.107	0.808	0.004
Low-Dishonesty	0.319	0.027	0.002	0.652
Source: SOI				

and Dishonesty most-likely classes belonging to the Low-Dishonesty latent class. Together, this indicates that it is primarily the Low-Dishonesty class that reduces the classification quality in the *k*=4 solution. This dynamic can be further explored by examining the movement of people between different classes across solutions with different *k* classes. Doing so provides an indication of how LCA is dividing up the data.

Table A14.3 shows a three-way cross-tabulation of change in most-likely class membership between *k*=2, *k*=3 and *k*=4 classes. This information helps to illuminate how the LCA is constructing the latent classes across different solutions. Reading the columns from top-to-bottom shows how the classes in the *k*=4 model are put together from members of *k*=2 and *k*=3 solutions. The High and Low classes in the *k*=4 solution are drawn almost entirely from people in the High and Low classes in both two and three class solutions. In contrast, the Dishonesty class in the *k*=4 model is drawn much more widely. This class comprises: first those who were in the High class in *k*=2 and *k*=3 solutions, those who moved from the High group in the two class solution to the Dishonesty group in the three class solution, those who were classified in Low and then Dishonesty groups across *k*=2 and *k*=3 and those who remained in Low groups in both two and three class solutions. Finally, the Low-Dishonesty class is almost exclusively made up of those who moved from the Low class in the *k*=2 solution to the Dishonesty class in the *k*=3 model, and people grouped into the Low class in both two and three class models.

These findings help to explain the low average class probabilities, and subsequent low entropy, of the *k*=4 model. The Low-Dishonesty class is primarily drawn from those who were classified into the Low class in the *k*=2 model and then remained in the class in the *k*=3 model or were split off to form part of the Dishonesty class in the *k*=3 solution. This implies that the members of this class have similar convictions patterns to members of the Low class and the Dishonesty class. The high probability of classification into the Low class for members of the Low-Dishonesty class (and vice versa) and classification

into the Low-Dishonesty class for members of the Dishonesty class in the *k*=4 model similarly imply a difficulty to clearly distinguish between these classes. It should be noted though, that the Dishonesty and Low classes in the *k*=3 solutions do not have exactly the same properties as the similar classes in the *k*=4 solution, as shown in Figure A14.1.

Table A14.3 Membership of most-likely class, two, three and four class solutions

		k=4					
k=2	*k*=3	Dishonesty	High	Low	Low-Dishonesty	*Total (k=3)*	*Total (k=2)*
High	Dishonesty	5,177	0	0	57	*5,234*	*31,478*
	High	8,305	14,873	1,496	5	*24,679*	
	Low	34	14	1,509	8	*1565*	
Low	Dishonesty	4,026	0	0	16,548	*20,574*	*468,882*
	High	720	129	2	1	*852*	
	Low	1,777	257	309,987	135,435	*447,456*	
Total (k=4)		*20,039*	*15,273*	*312,994*	*152,054*	*500,360*	

Source: SOI

Notes for Figure A14.1

1. Different age-bands are presented on different scales. This is due to the distorting effect of the high estimated conviction rate for class three in the *k*=5 solution
2. Classes are listed in the order produced by the LCA model. This class numbering has no intrinsic meaning, and classes with similar profiles can be produced as different class numbers between different solutions.
3. Crime types are listed with the following abbreviations:

bop = breach of the peace
cd = criminal damage
dis = dishonesty
dru = drugs offences
other = all other crimes and offences
vio = violence

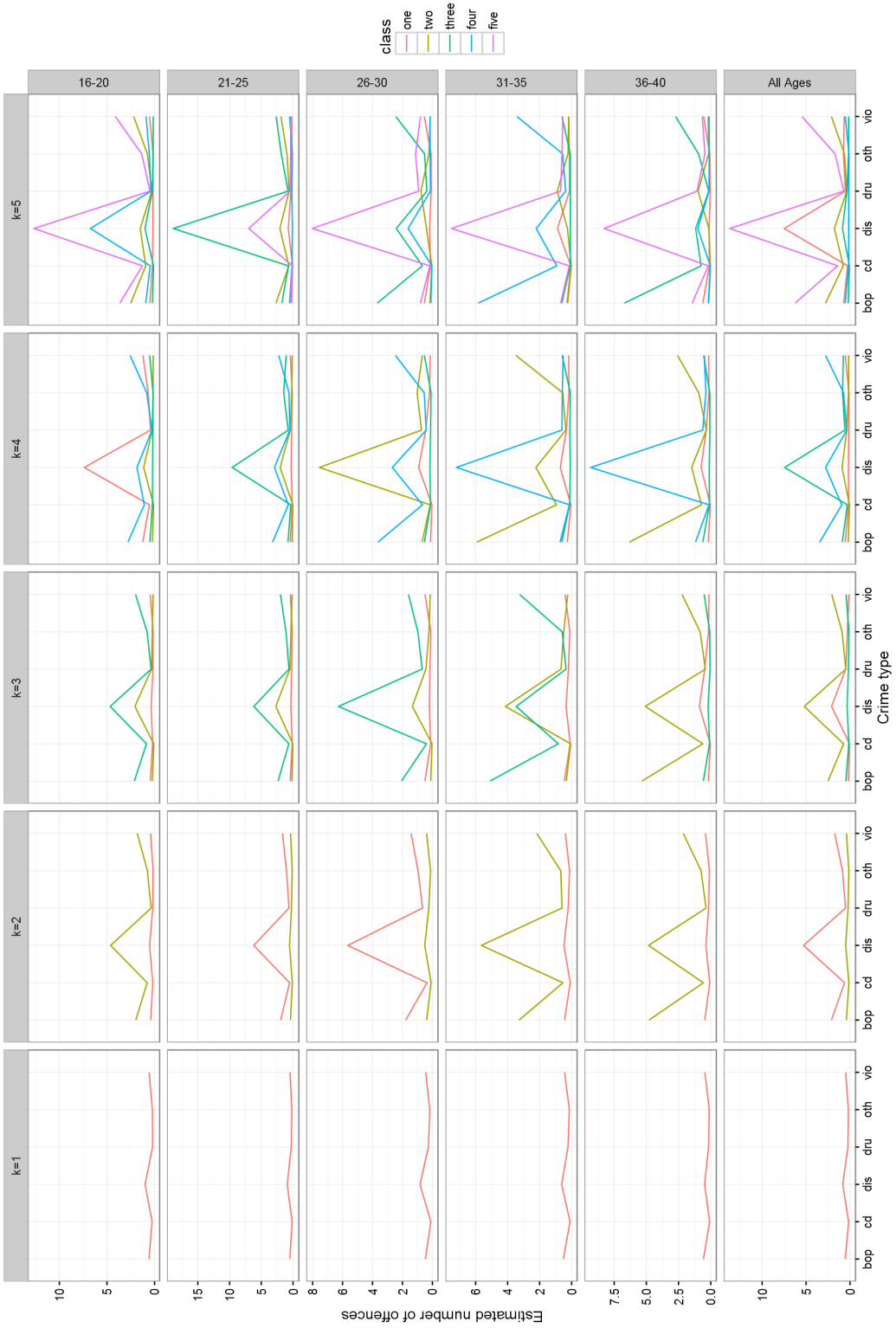

Figure A14.1. Profile of different *k* latent class solutions for different age groups

Appendix 15. Change in membership of latent classes for men and women of different ages

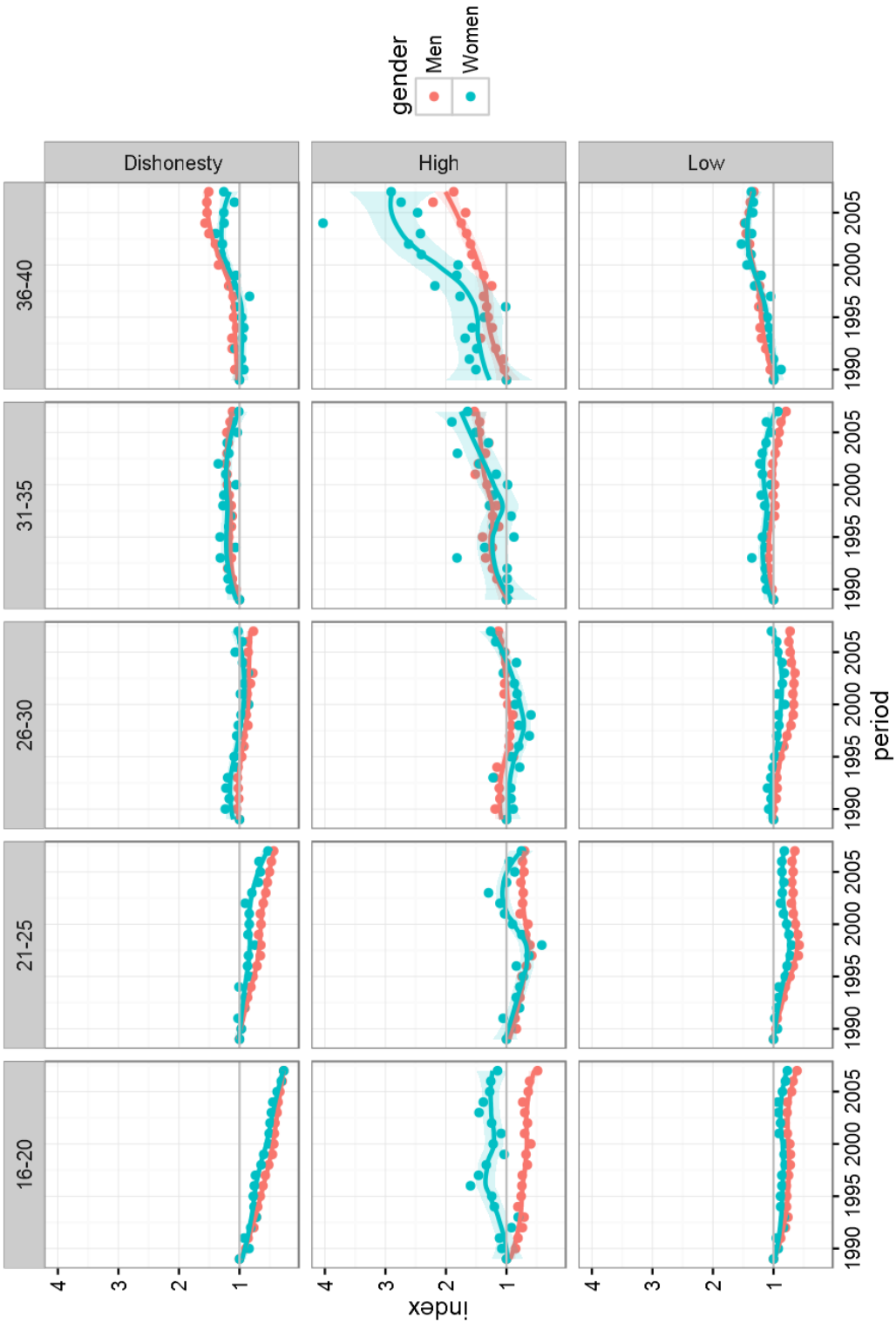

Figure A15.1. Membership of different latent classes in SOI for men and women of different ages, three class solution (Index 1989 = 100)

Appendix 16. Comparison of proportion of people classified into latent classes and proportion of convictions for different crime types served to latent classes

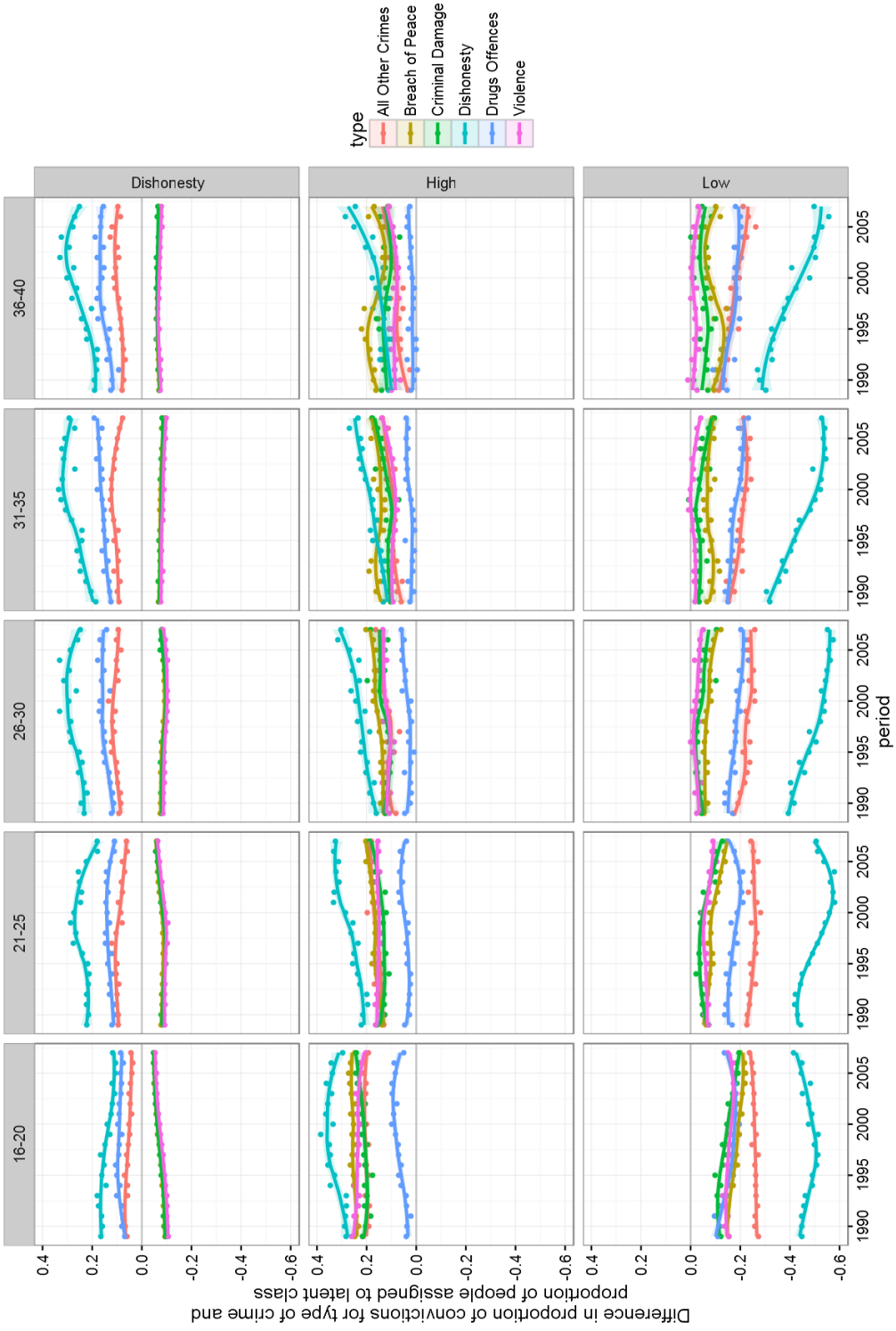

Figure A16.1. Comparison of class membership proportions and proportion of convictions for different types of crime assigned to latent classes, 1993-2007 (men). Note: Positive values show a higher proportion of convictions for a particular crime type compared to the size of the class.

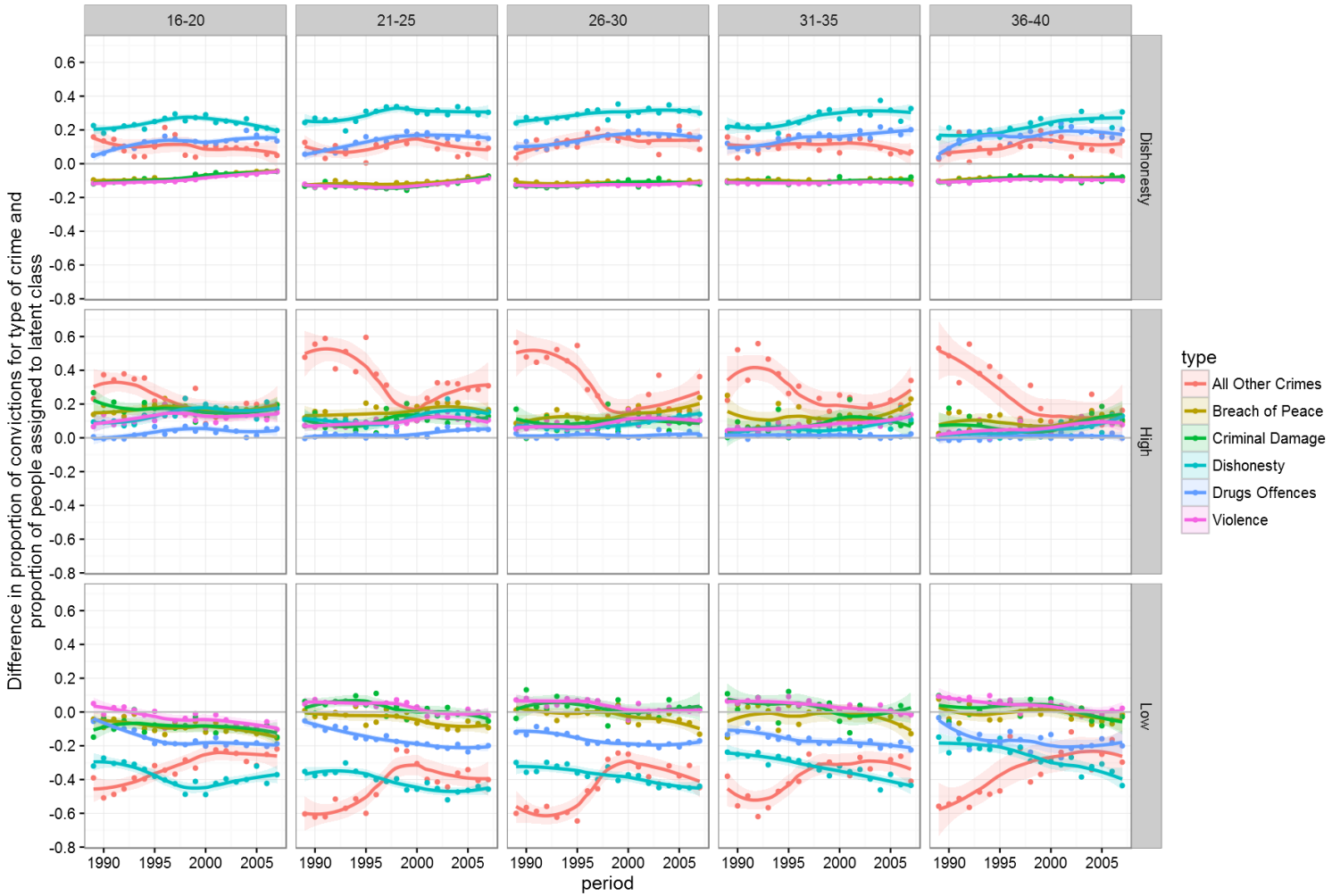

Figure A16.2. Comparison of class membership proportions and proportion of convictions for different types of crime assigned to latent classes, 1993-2007 (women). Note: Positive values show a higher proportion of convictions for a particular crime type compared to the size of the class.

Appendix 17. Transitions between latent classes using most likely class assignment

Table A17.1 Discrepancy between transitions as a proportion of age-band one for different transition points

Sex	Age	Age-band one	Age-band two			
			Dishonesty	High	Low	No Conviction
Men	21	Dishonesty	-0.01	0	0.01	-0.01
		High	-0.01	0.01	0.01	-0.02
		Low	0	0	0.03	-0.04
		No Conviction	0	0	0	NA
	26	Dishonesty	0.02	0	-0.01	-0.01
		High	0.02	-0.01	-0.02	0
		Low	0	0	-0.02	0.01
		No Conviction	0	0	0	NA
	31	Dishonesty	0.01	-0.01	0	0
		High	0.01	-0.02	0.01	0
		Low	0	0	-0.01	0.01
		No Conviction	0	0	0.01	NA
	36	Dishonesty	-0.01	-0.02	-0.03	0.06
		High	-0.03	-0.02	0	0.04
		Low	-0.01	-0.01	-0.03	0.03
		No Conviction	-0.01	0	0.02	NA
Women	21	Dishonesty	0.01	0.01	-0.01	-0.01
		High	0.01	0.01	0	-0.02
		Low	0.01	0	0	0
		No Conviction	0.02	0	-0.02	NA
	26	Dishonesty	0.01	0	0.02	-0.03
		High	0.03	0	-0.03	0
		Low	0.01	0	0	0
		No Conviction	0	0	0	NA
	31	Dishonesty	0	-0.01	0.01	-0.01
		High	-0.01	-0.03	0.01	0.03
		Low	0	0	0.01	0
		No Conviction	-0.01	0	0.01	NA
	36	Dishonesty	-0.04	-0.02	-0.01	0.06
		High	-0.06	-0.03	0.05	0.04
		Low	-0.01	0	0	0.03
		No Conviction	-0.02	0	0.03	NA

Source: SOI

Appendix 18. Trends in transitions between latent classes

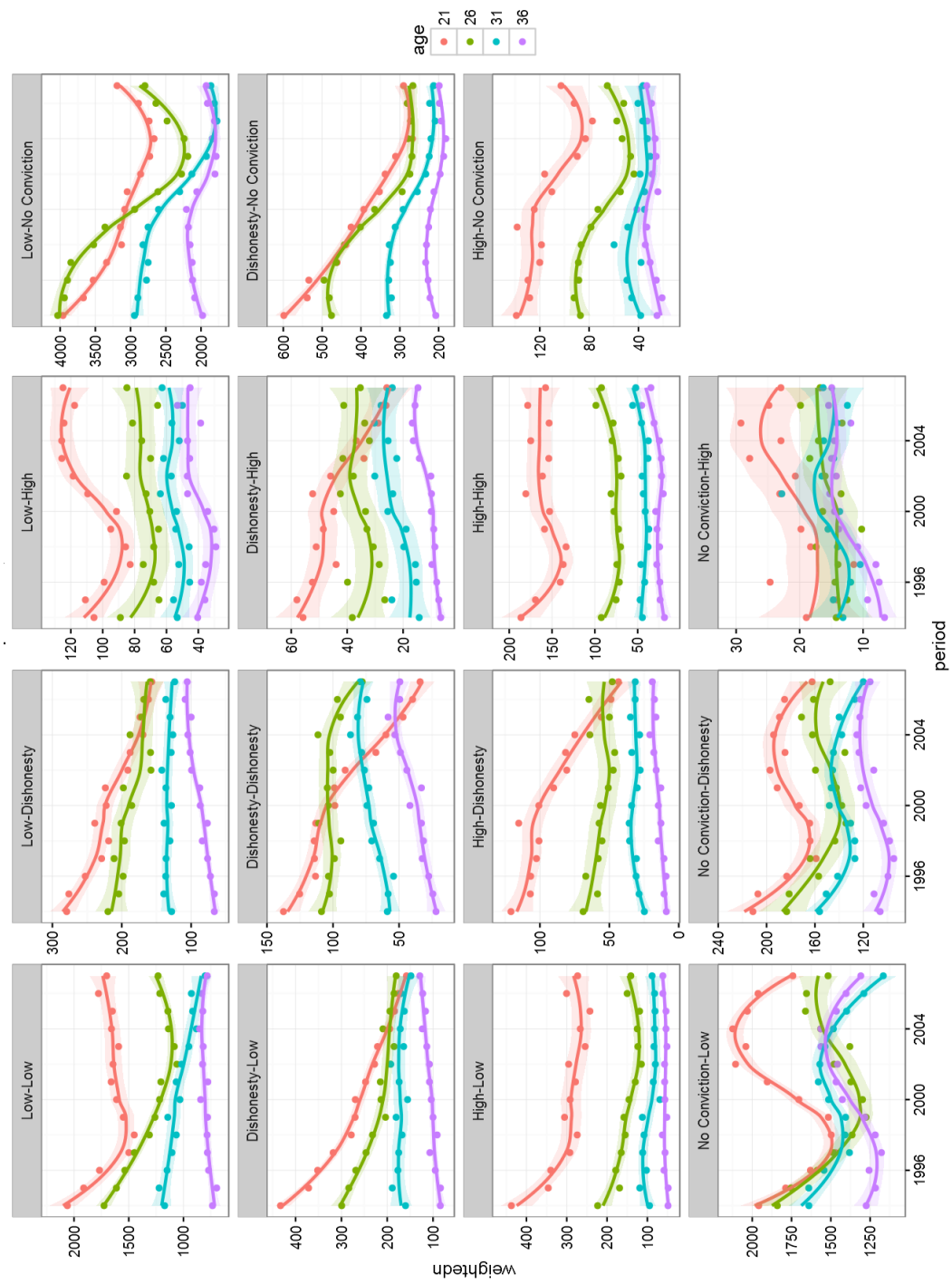

Figure A18.1. Number of transitions by latent class 1993-2007, men

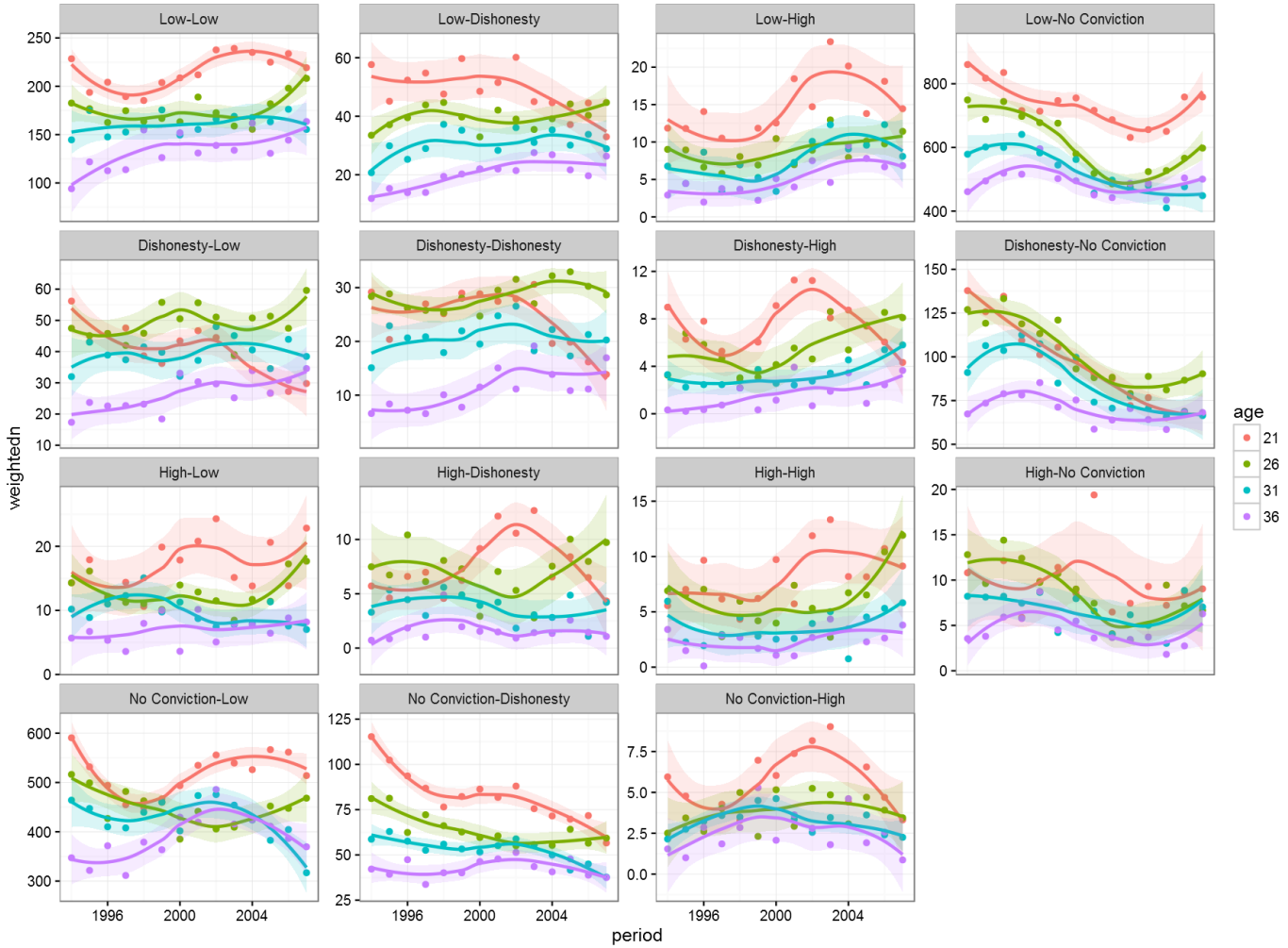

Figure A18.2. Number of transitions by latent class 1993-2007, women

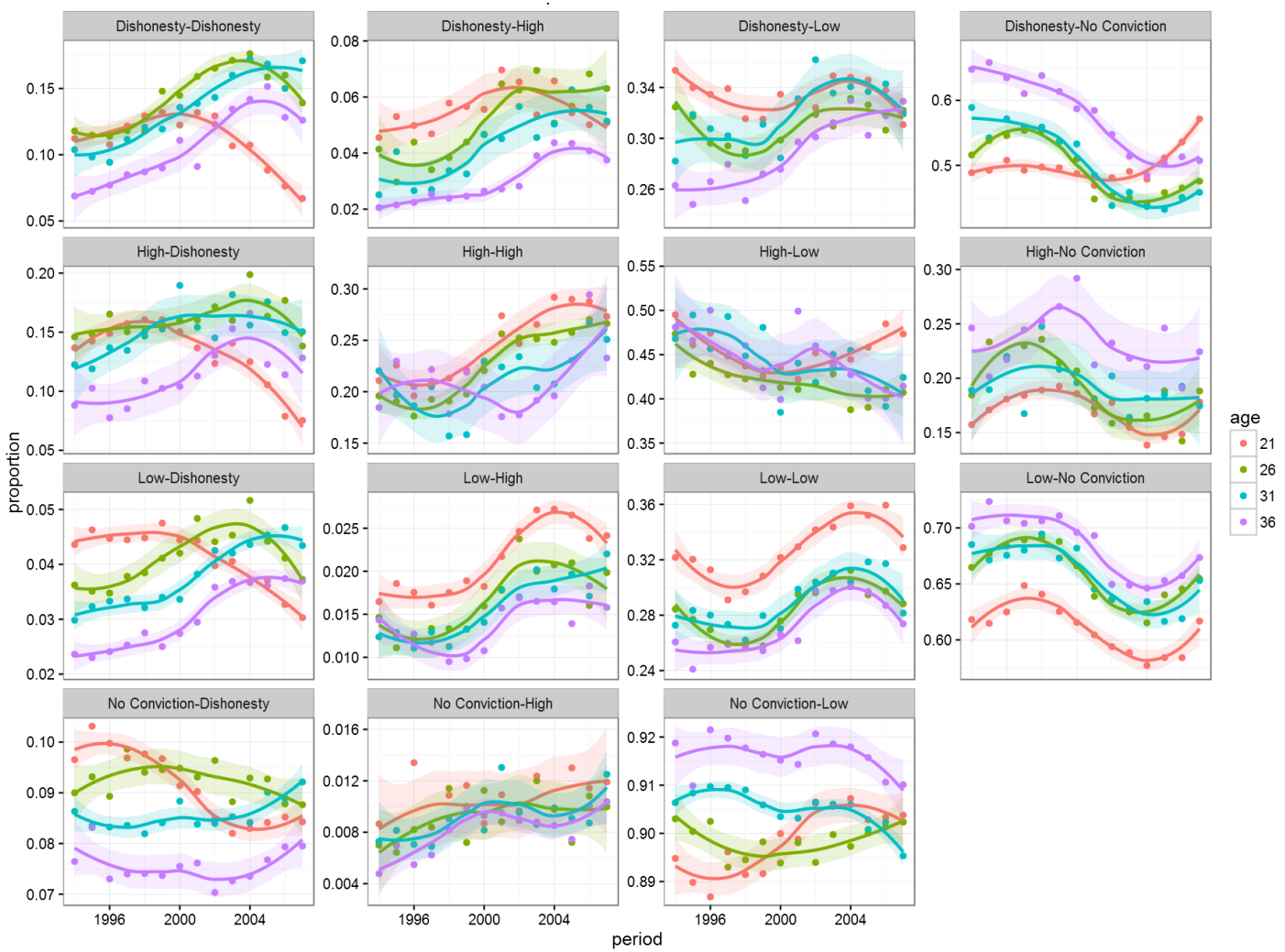

Figure A18.3. Proportion of prospective transitions by latent class 1993-2007, men

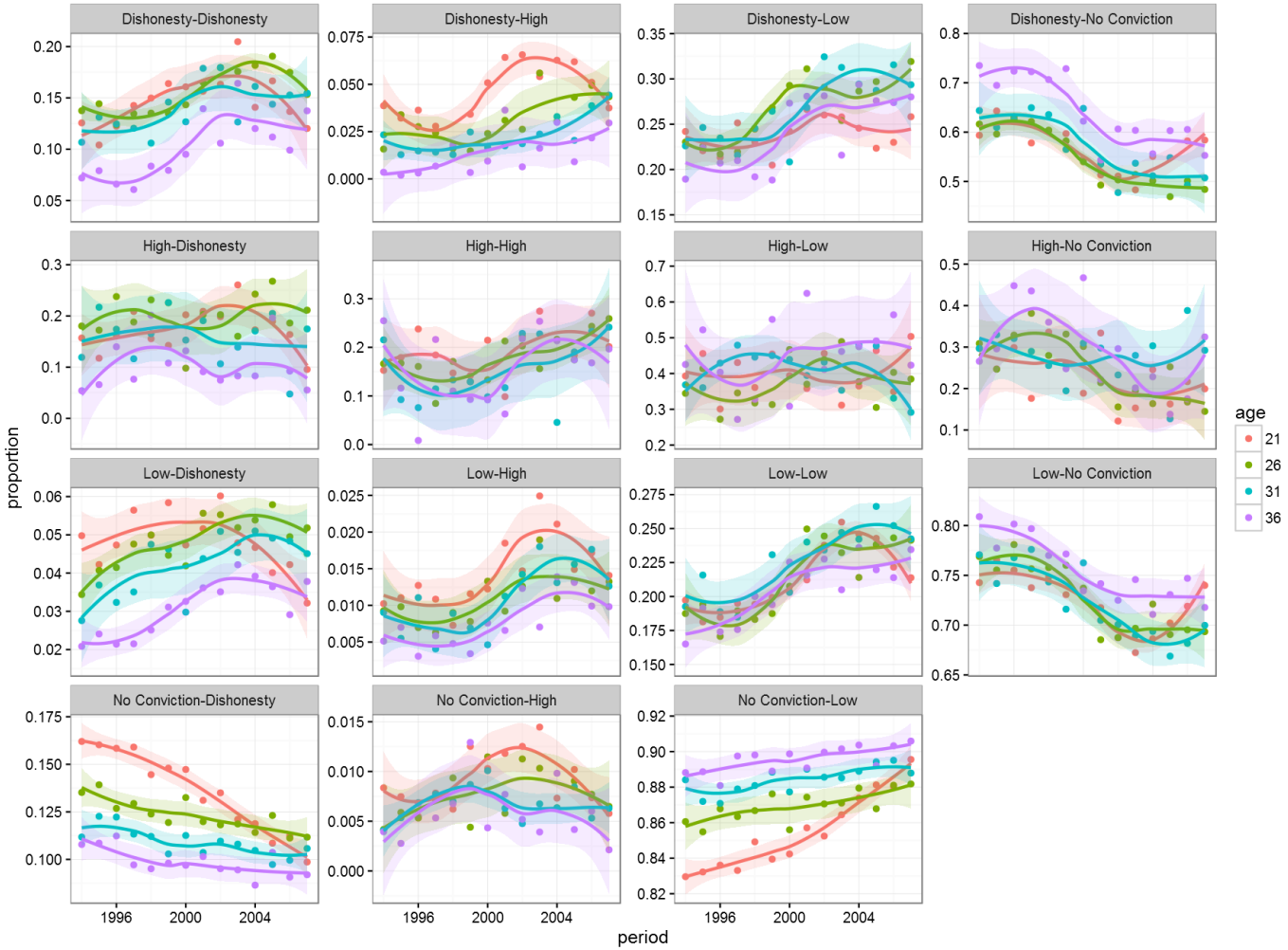

Figure A18.4. Proportion of prospective transitions by latent class 1993-2007, women

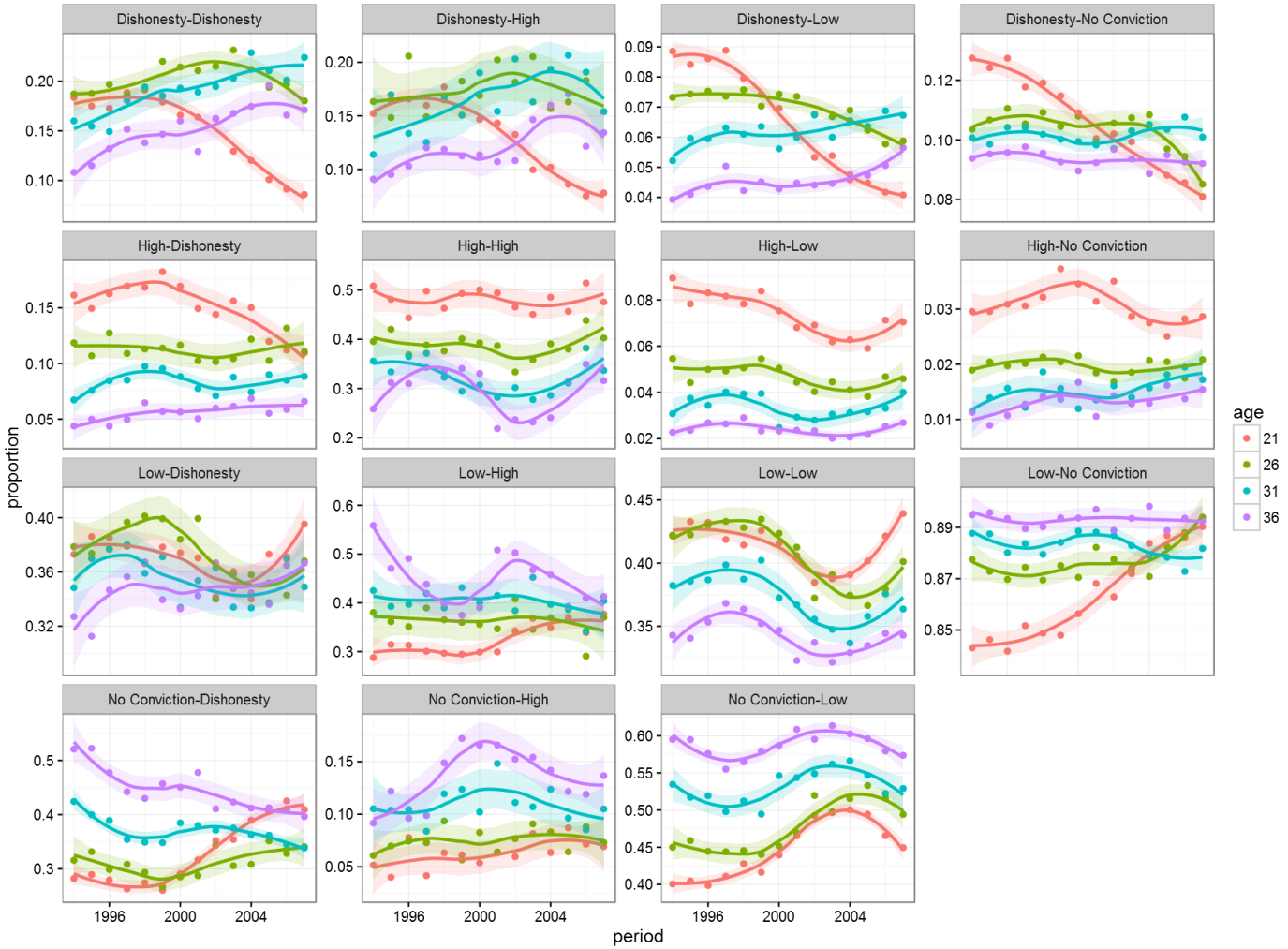

Figure A18.5. Proportion of retrospective transitions by latent class 1993-2007, men

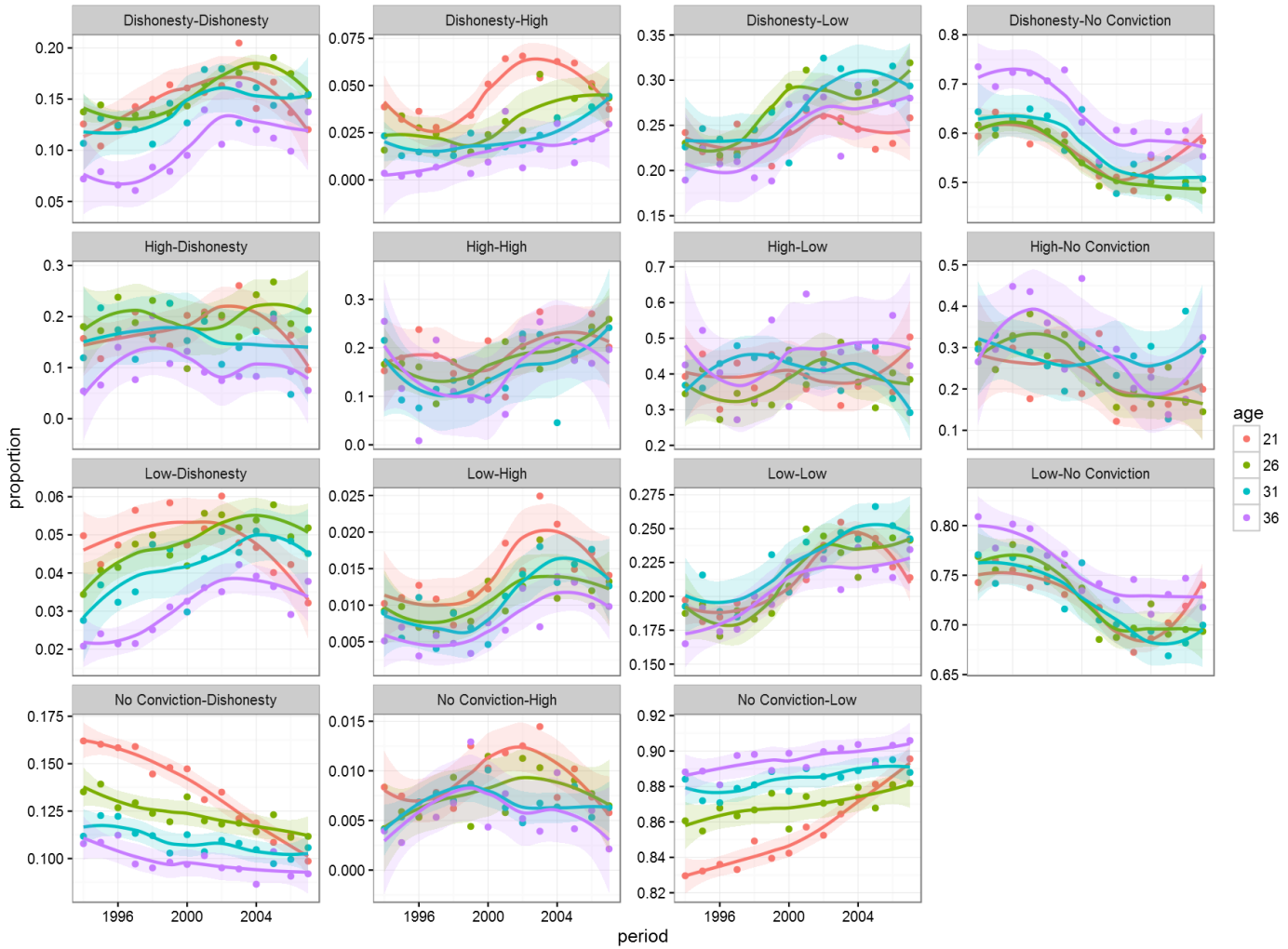

Figure A18.6. Proportion of retrospective transitions by latent class 1993-2007, women

Appendix 19. List of abbreviations

ABIC	Adjusted Bayesian Information Criterion
ACC	Age-crime Curve
AIC	Akaike Information Criterion
AL	Adolescent-Limited Offender
APC	Age-period-cohort effects
BIC	Bayesian Information Criterion
BLRT	Bootstrapped Likelihood Ratio Test
CEE	Central and Eastern Europe
CHS	Children's Hearing System
COPFS	Crown Office of Procurator Fiscals
GIRFEC	Getting It Right For Every Child
HMP	Her Majesty's Prison
HMYOI	Her Majesty's Young Offender Institution
IC	Information Criterion
LCA	Latent Class Analysis
LGBTQ	Lesbian, Gay, Bisexual, Trans and Queer
LGCA	Latent Growth Curve Analysis
LTA	Latent Transition Analysis
NRS	National Records of Scotland
PAI	Percentage Age Involvement
SNP	Scottish National Party
SOI	Scottish Offenders Index
VLMR	Vuong–Lo–Mendell–Rubin Likelihood Ratio Test

Appendix 20. List of figures and tables

Figure 2.1 The relationship between age and crime for American males. 15
Figure 3.1. Trends in recorded crime in Scotland. 48
Figure 3.2 Comparison of trends in non-court disposals, convictions and recorded crime. 75
Figure 3.3 Non-court disposals and convictions as a proportion of recorded crime. 76
Figure 5.1 Assessing Age, Period and Cohort effects in a shaded contour plot 112
Figure 5.2 Illustration of Latent Class Analysis 123
Figure 6.1. Age-crime curves in SOI 1989-2011 140
Figure 6.2. Age-crime curves for different crime types in SOI 1989-2011, men 144
Figure 6.3. Age-crime curves for different crime types in SOI 1989-2011, women 145
Figure 6.4. Comparison of percentage change in prevalence of convicted offending in SOI 1989-2011 146
Figure 6.5. Shaded contour plot of convicted offending for different ages in SOI, 1989-2011. 152
Figure 6.6. Shaded Contour Plot of prevalence of convicted offences (standardized) for different crime types in SOI 1989-2011, men 158
Figure 6.7. Shaded Contour Plot of prevalence of convicted offences (standardized) for different crime types in SOI 1989-2011, women 162
Figure 7.1 Comparison of the frequency of convicted offending, 1989-2011, ages 16-60 171
Figure 7.2 Frequency of conviction of different crime types in Scotland in 1989 and 2011, men 173
Figure 7.3 Frequency of conviction of different crime types in Scotland in 1989 and 2011, women 174
Figure 7.4 Shaded contour plot of the frequency of conviction of all crime types in Scotland 1989-2011 176
Figure 7.5 Shaded contour plot of age-structure change for men and women aged 16-60 in Scotland 1989-2011 179
Figure 7.6 Contributions of age structure, prevalence and frequency to the aggregate convicted offending rate 1989-2011, men 183
Figure 7.7 Contributions of age structure, prevalence and frequency to the aggregate convicted offending rate 1989-2011, women 185
Figure 7.8 Contributions of age structure, prevalence and frequency to the aggregate convicted offending rate 1989-2011, 1989-2000, 2000-2007, 2007-2011 men 191
Figure 7.9 Contributions of age structure, prevalence and frequency to the aggregate convicted offending rate 1989-2011, 1989-2000, 2000-2007, 2007-2011 women 195
Figure 8.1 Numbers of people convicted in five-year agebands, 1989-1993 to 2007-2011 204
Figure 8.2 Mean number of convictions in five year periods, 1989- 206

2011
Figure 8.3 IC results for LCA solutions for different k classes 207
Figure 8.4 Profile of different k classes for LCA solutions estimated for different age bands and SOI as a whole 209
Figure 8.5 Change in the proportion of people assigned to different latent classes 211
Figure 8.6 Proportion of men and women of different ages assigned to latent classes 213
Figure 8.7 Trends in the frequency of conviction for different latent classes 216
Figure 8.8 Trends in the frequency of conviction for different latent classes split by ageband 217
Figure 8.9 Trends in the proportion of total convictions attributable to latent classes 218
Figure 8.10 Trends in proportion of total convictions attributable to different latent classes in different ages 221
Figure 8.11 Change in the proportion of convictions for different crime types and latent classes 224
Figure 8.12 Trends in the proportion of convictions for crimes of dishonesty served to each ageband 227
Figure 9.1 Number of people who desist, persist or onset in consecutive age-bands, 1993-2007 237
Figure 9.2 Proportion of people with convictions in consecutive age-bands, 1993-2007 239
Figure 9.3 Proportion of people who desist, persist or onset in consecutive age-bands, 1993-2007 242
Figure 9.4 Proportions of prospective transitions by latent class, men 251
Figure 9.5 Proportions of prospective transitions by latent class, women 257

-

Table 2.1 Summary of existing studies examining change in persistent offending over the course of the crime drop 35
Table 4.1: Offences of different crime types in SOI (1989-2011) 96
Table 4.2: Sex of people listed in SOI (1989-2011) 101
Table 5.1 Illustration of calculating weighted transitions between age-bands 133
Table 6.1. Comparison of change in rates of convicted offending for men and women aged 17 and 30 in 1989 and 2011 141
Table 6.2. Descriptive Statistics for Age-crime Curves in 1989 and 2011 split by sex 142
Table 6.3. Change in the rate of convicted offending at peak age 1989-2011 for men and women across crime types 150
Table 7.1. Standardization and Decomposition of convicted offending rates by age, prevalence and frequency, men 1989-2011. 182
Table 7.2. Standardization and Decomposition of convicted offending rates by age, prevalence and frequency, women 1989-2011. 184
Table 7.3. Standardization and Decomposition of convicted 189

offending rates by age, prevalence and frequency, men 1989-2000, 2000-2007, 2007-2011.
Table 7.4. Standardization and Decomposition of convicted offending rates by age, prevalence and frequency, women 1989-2000, 2000-2007, 2007-2011. 194
Table 7.5. Comparison of relative contributions of age, prevalence and frequency to overall convicted offending rates for men and women 1989-2000, 2000-2007, 2007-2011. 198
Table 8.1 Class proportions for LCA estimated on all age bands (posterior probabilities) 210
Table 9.1 Comparison of the difference in the proportion of men and women making different transitions between 1998 and 2004. 244
Table 9.2 Numbers and proportions of men and women who make different transitions in SOI 248

Appendix 21. Unsmoothed contour plots

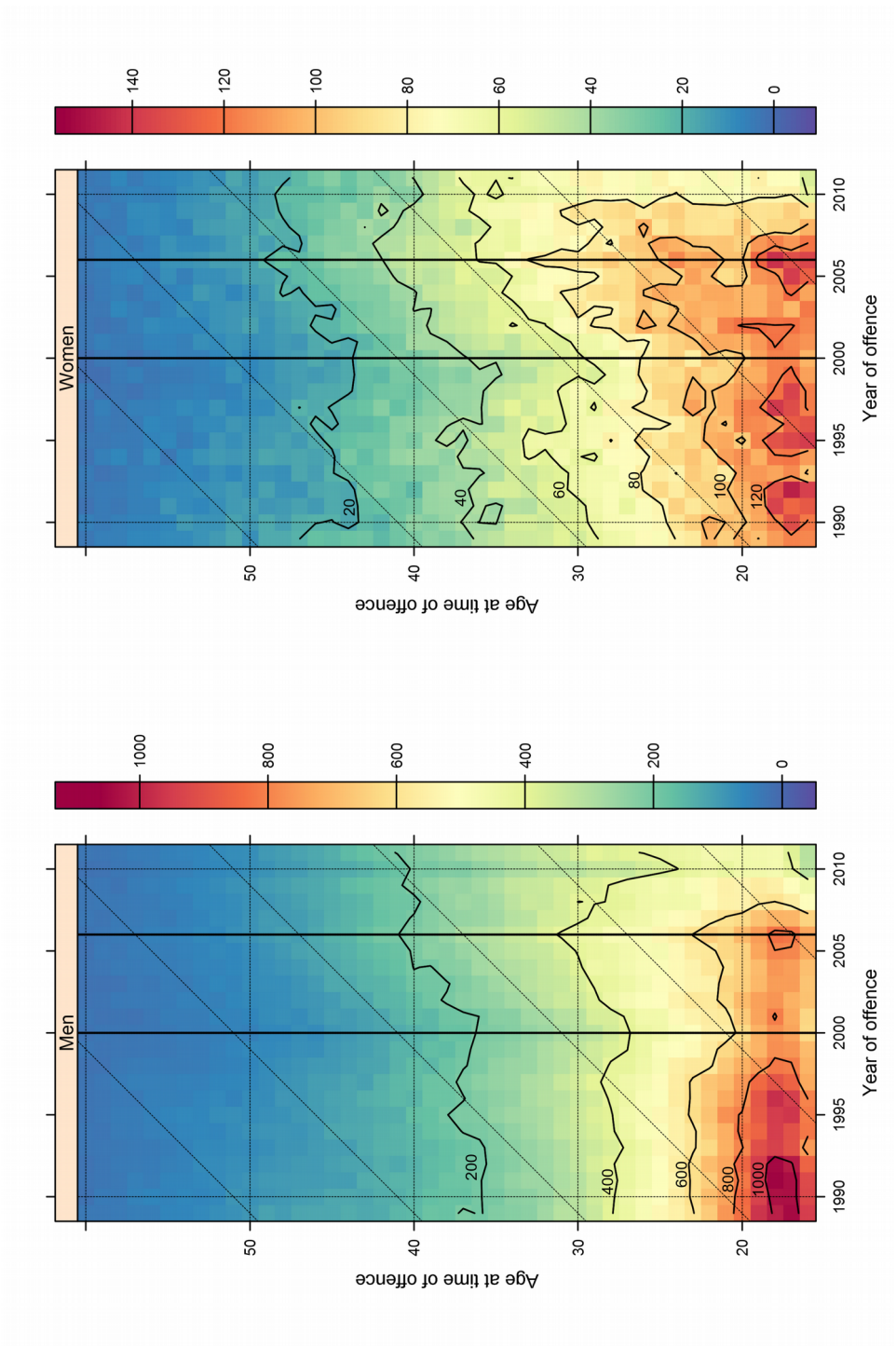

Figure A21.1. Unsmoothed shaded contour plot of convicted offending for different ages in SOI, 1989-2011 (unsmoothed Figure 6.5)

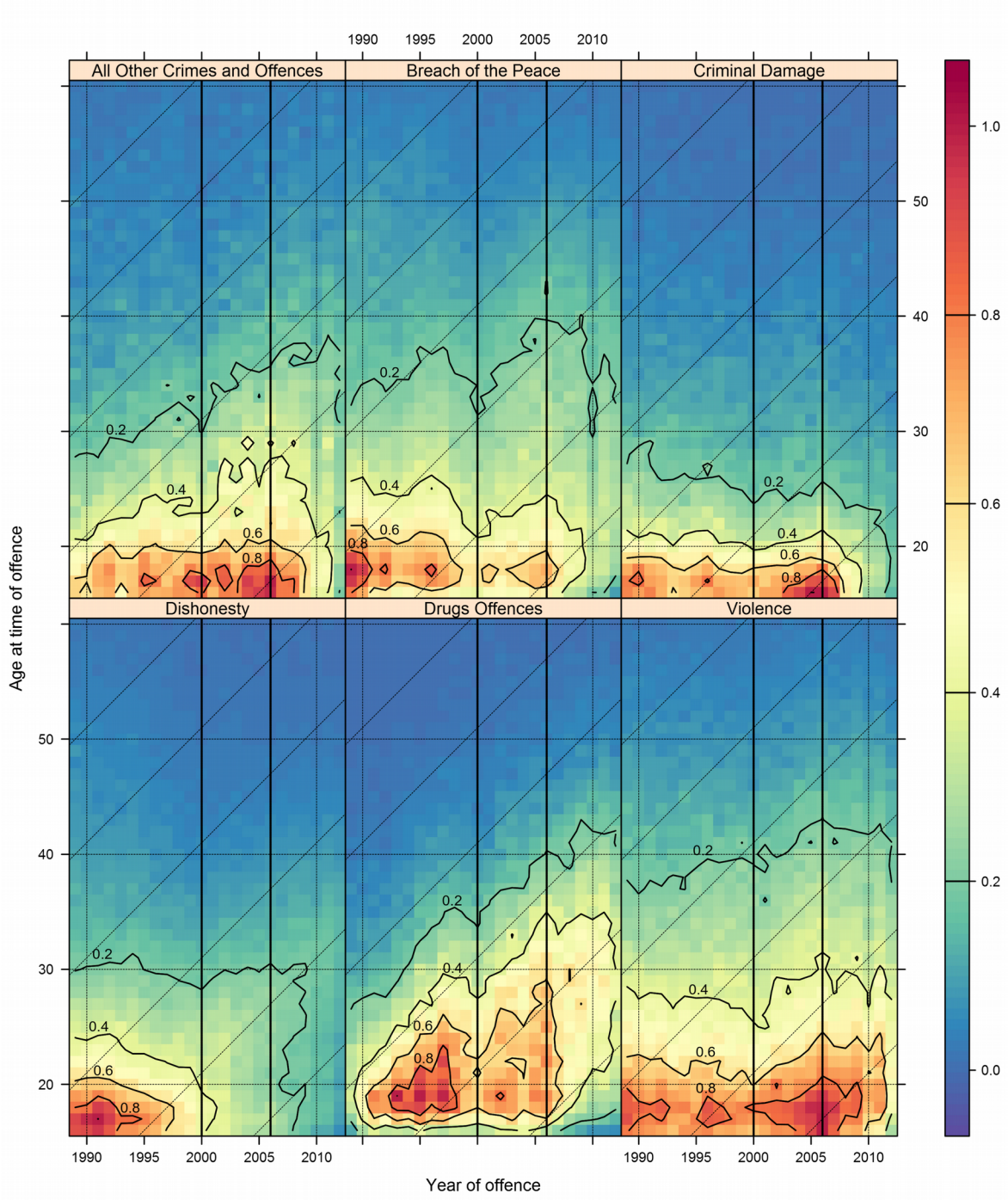

Figure A21.2. Unsmoothed shaded contour plot of prevalence of convicted offending (standardized) for different crime types in SOI, 1989-2011, men (unsmoothed Figure 6.6)

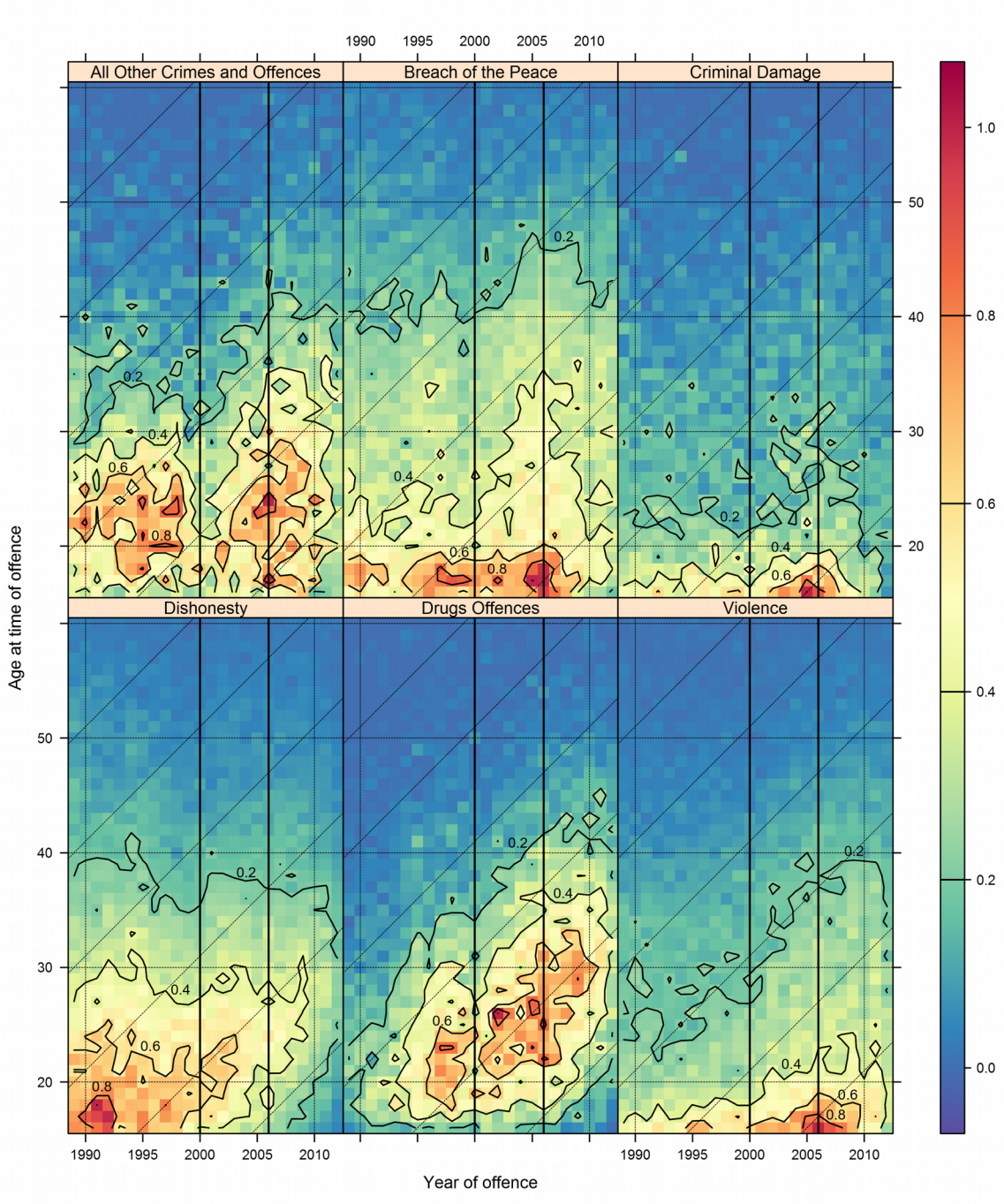

Figure A21.3. Unsmoothed shaded contour plot of prevalence of convicted offending (standardized) for different crime types in SOI, 1989-2011, women (unsmoothed Figure 6.7)

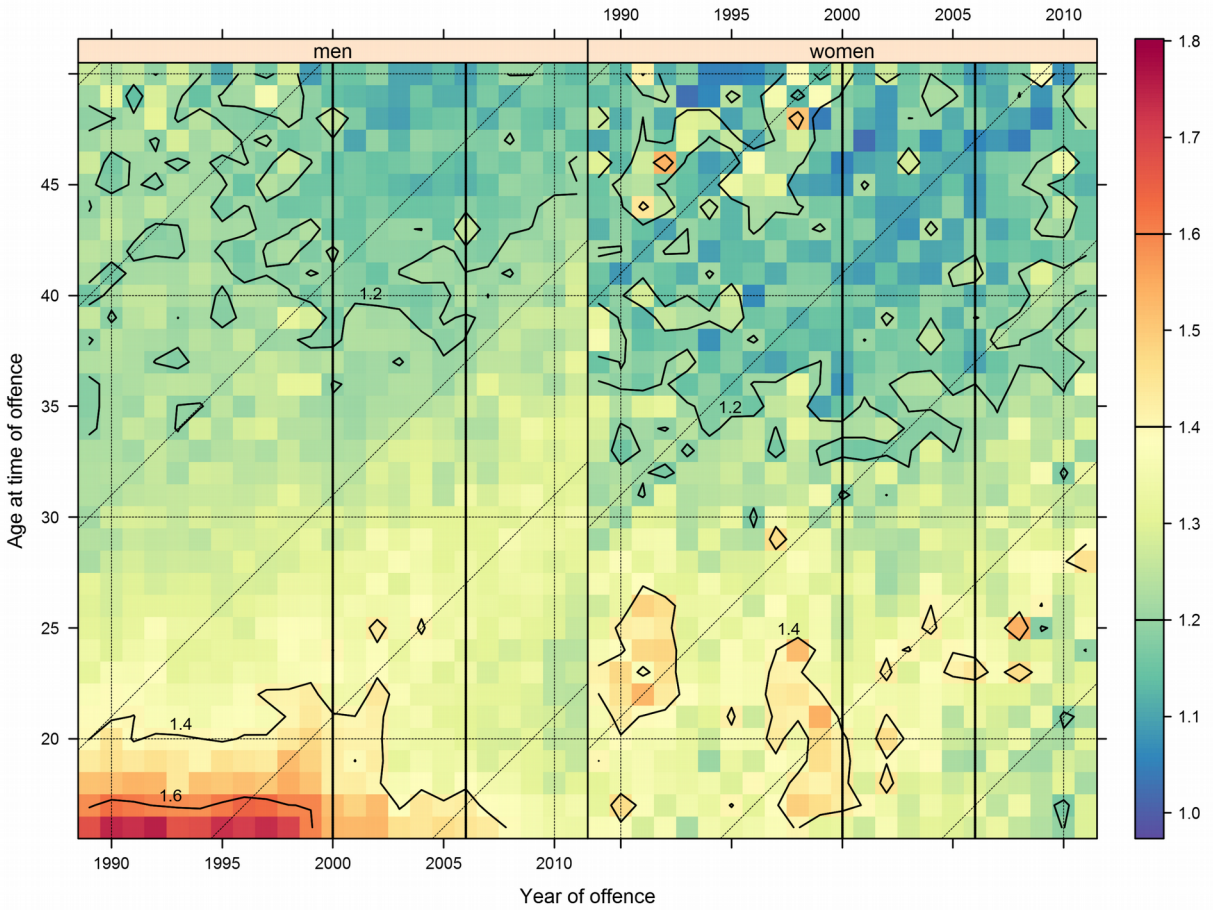

Figure A21.4. Unsmoothed shaded contour plot of the frequency of conviction of all crime types in Scotland 1989-2011 (unsmoothed Figure 7.4)

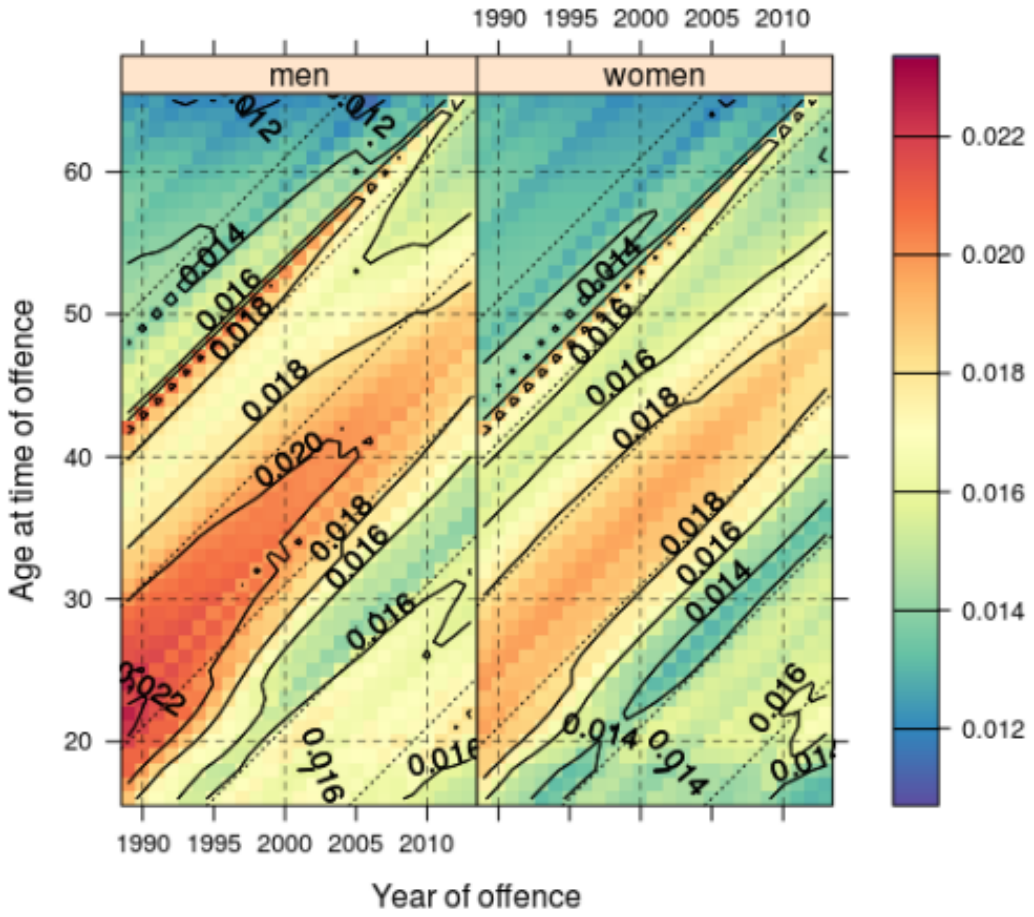

Figure A21.5. Unsmoothed shaded contour plot of age-structure change for men and women aged 16-65 in Scotland 1989-2011 (unsmoothed Figure 7.5)

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